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Classified Advertisements—Supp. 11.
Index to Advertisers—Page xxxii.

Work in Progress

Trends in Design

A TOUR through the shops and drawing offices of manufacturers at the turn of the year not only reveals fine examples of engineering but also gives an inkling as to what the future may have in store. Taking the generating end first, there is the second set for Brimsdown A (60,000 kW) designed for steam conditions of 1,900 lb. per sq. in. and 930 deg. F., from which it may be assumed that the first set is giving satisfactory results. In most cases there is still a tendency to stop at 625 lb. and about 800 deg. F., at the same time bringing extensions at older stations up to these values. In view of the present intensive research into the behaviour of steels at very high temperatures it would, however, be rash to dogmatise.

High-voltage Alternators

High-voltage work is strikingly exemplified by the large number of alternators (some of over 50,000 kW) wound for 20 kV to 36 kV. One company alone has built more than a million kVA of such machines within the past few years. Reactors for the purpose of limiting the energy liberated under short circuit are under construction for 132 kV to give 10 per cent. reactance on 50,000 kVA. There has been a falling off in orders for large transformers for this voltage, but compensation is to be looked for in the increasing number of lower-voltage distribution transformers required.

Probably the most notable examples of high power-weight ratio in generation are the 50,000-kW turbo-alternators under construction for the new Bunnerong station of Sydney County Council, N.S.W. They have the largest output of any set built in this country for 3,000 RPM and are approached in this respect only by the 40,000-kW machines being made by another company for Ferrybridge (Y.E.P. Co.). Under the heading of labour-saving come the various remote supervisory-control and other automatic systems. While no outstanding novelty offers itself at the moment in the group, the principles entailed are obviously growing in favour, especially for traction sub-stations, for which large numbers of rectifiers (many of the grid-controlled type) are in course of manufacture.

A high state of reliability is indicated by the uninterrupted service given during long runs by boilers as well as turbines and electrical plant generally, duplicates of which are on order, either of a complex character or for use under onerous conditions. Included in the latter are the numerous internal-combustion engines (up to 3,500 BHP) being built for export. Another instance is to be found in the connection of 33-kV transformers direct to overhead lines without the need for protection.

Switchgear may also be conveniently considered in connection with reliability. For heavy duties reliability is closely associated with rapidity in operation. Most of the improvement made during the last few years is due to the institution of testing stations. Before these came, we are informed by one large manufacturer, total break times of from 15 to 20 cycles represented the usual order of things; the period was reduced to from 8 to 10 cycles by the introduction of arc-control devices and now the most advanced types require only three cycles (0.06 sec.) at from 30 per cent. of rating upwards. This last represents the performance of the 2,000 MVA 132-kV impulse-type circuit breakers to be installed at Littlebrook, which have the same rupturing capacity as the 66-kV single-break type for Battersea B.

The new Littlebrook station, some constructional features of which were included in our last issue, is also said to be the first to be equipped with high-rupturing capacity air-break switchgear. High-speed operation being very much a matter of the working of protective gear, the use of carrier currents for the purpose is especially interesting; one good feature of the system is that discriminative action does not depend upon the inherent operating speed of the relay.

Increased Safety

As to safety, one of the most important contributions is the application of spring reclosure to feeder circuit-breakers. Others that may be cited are the development of air-cooled transformers and of those in which the quantity of oil is much reduced or in which non-inflammable insulating fluid is employed.

Space does not permit reference here to more than one section of the heavier engineering products that owe so much under all headings to the initiative in research displayed by British manufacturers. We have not touched upon the equally imposing achievements in cable manufacture, in the huge field of utilisation or in light-current work. The large

number of contracts in hand that are repeat orders, including the high proportion received from overseas when competition is on a quality basis, provide more than an indication of technical tendencies. They also furnish proof that the products do what they are intended to do.

Loan Periods Extended

THERE has been a good deal of discussion during the last few months about the repayment periods of loans raised for the purchase of domestic electrical appliances and meters. Only two or three months ago the Electricity Commissioners told the London J.E.A. that they could not extend the repayment period for existing loans, but it was suggested that some extension might be allowed in future instances. Now the Commissioners have decided that the "lives" of cookers and meters justify the spread of repayment of their cost over substantially longer periods; they have raised the cooker-loan time from seven to ten years, while for standard AC meters the period has been extended from ten to fifteen years. The question of water-heaters and wash boilers remains under consideration. The latter, we think, are in use for such comparatively short periods that if they are equipped with thermal cut-outs they should last at least as long as a regularly used cooker. Water-heaters, of course, are subject to widely varying conditions of use which makes a decision difficult.

The Cold Snap

THE ill winds that prevailed for a week before Christmas blew both the electricity and gas industries good. Although the sudden access of load due to the switching-on of innumerable heaters caused a little difficulty in some localities, the demand was met successfully. The peak was reached on December 20th, when the grid, operating as one connected system, was called upon for 6,714,000 kW, which constituted a record, and an increase of 15 per cent. as compared with the demand on December 13th. The rate of increase of consumption shown by the Commissioners' monthly returns has slowed down in recent months, but we expect a sharp advance to be recorded for December, which should raise the monthly average for 1938. The other side of the shield is the effect of the severe weather on the transport system, which will no doubt partly offset the gain due to heating. In London the Transport Board was given a great deal of trouble by frost and snow rendering the operation of trams and trolley buses very difficult and making the public reluctant to travel. The Southern Railway also had to curtail its services for a few days and thus cut down its electricity consumption.

Motor-starting Resistances

PUBLISHED information on the design of starting and controlling resistances for electric motors is scanty considering their wide use. Their manufacture is in the hands of a comparatively few concerns, and outside the staffs employed by them there appears to be little knowledge of the principles involved and the methods adopted in their design. Much of the work involved is of a more or less routine character calling for the use of tabulated data. It is probably safe to say that those engaged on this part of the work have often but a rudimentary understanding of the considerations upon which the tables they use are based. In this issue Mr. W. de Renzi shows how design tables for DC working may be derived from a study of underlying principles.

IN THIS ISSUE

Articles:	*Page*
Lighting Municipal Buildings	*927*
Seaside Hotel Installation	*930*
The E.C.A.	*931*
Credit and Prepayment Consumers	*933*
Designing Resistances	*935*
News:	
Irish Engineers' Association	*939*
Safety in Mines	*940*
Manufacturers' Activities	*943*
American-Canadian Trade Agreement	*946*
Meter Patent Amended	*947*

Electrical Contractors

THE third article in our series dealing with the organisations of the electrical industry describes the origin and work of the Electrical Contractors' Association. The progress made by this body has been very remarkable for the organisation of a large number of individual concerns (often very individualistic) is a colossal task. The consistent aim of the Association to raise the standard of installation work has not, we are afraid, always received the whole-hearted support of supply authorities or the public. The former should know better, but the latter cannot be expected to distinguish the good from the bad, and should be guided by the supply authorities. What the contractors' future is to be is still obscure, but readers will agree, upon reading the very fair presentation of the Association's history on page 931, that they deserve well of the electrical industry and the community as a whole.

Colliery Electricians

PROBABLY the most important, in the electrical sense, of the findings of the Royal Commission on Safety in Mines are those relating to the qualifications of electricians. Electricians in charge of the larger installations will, if the recommendations are adopted, be required to pass a written examination and their leading assistants an oral examination, while subordinate electricians will hold service certificates, also based upon oral test. Certification will presumably be made easy for men who by their work in the past have shown themselves well fitted for their duties and the oral examination suggested is a good feature in the circumstances, as many sound practical men do not do justice to themselves on paper. The examinations are to be set by the Association of Mining Electrical Engineers—a much more suitable authority for the purpose than a State organisation would be. Indeed, the unofficial certificates now issued by the Association ought to be a big help in bringing the new scheme into operation. It will be important, however, to ensure that electricians are given full authority to exercise the responsibility to be legally imposed on them. The Commission also points out the advantage of having both electrical and mechanical plant under the charge of one suitably qualified person. This should provide a good opening for men with the required experience.

New Mining Regulations

CONSIDERING that the Regulations governing the use of electricity in collieries were drawn up in 1913, it is a tribute to the foresight shown in their compilation that they meet present conditions so well. Evidence presented before the Royal Commission indicates the need for some revision, and it is recommended that a committee of engineers should be appointed for the purpose. Apart from ignitions of firedamp (largely a matter of ventilation for which electrical engineers are not responsible), most electrical accidents below ground are due to shock and are usually associated with flexible cables, plugs and switchgear. Provision in new regulations for compulsory compliance with the B.S.S. requirements for apparatus and cables will no doubt meet with general acceptance, but it is surprising to find that there should be any doubt about the advisability of stipulating that trailing cables should be of the screened type, as all the information we have supports the view that they should. Other points for the proposed committee are a more extended use of earth-leakage protection and of the remote control principle and greater stringency as regards earthing the AC neutral point.

Lighting of Municipal Buildings

How the demand for "exclusiveness" is being met

IN all parts of the country new civic buildings are rising and manufacturers of electric lighting equipment appear to be developing a special technique in meeting the demands resulting from the eagerness of municipal authorities to "go one better" each time in striving for combined effect and utility lighting. By the kind co-operation of a few of the manufacturers who specialise in this kind of work we propose to try to show in the following notes how this special technique has arisen and is being developed.

A feature of the lighting appointments in municipal buildings, says the General Electric Co., Ltd., is usually an exclusiveness of design and a dignity befitting the particular building or civic authority concerned. Most civic authorities are jealous of the traditions attaching to their administrative surroundings, and this is often bound up with some special "atmosphere" related to the centres. Further, many of these centres of local government are responsible for the supply of electricity in their areas, and the installation of lighting of a high standard at their headquarters bears witness to the fact that they have a profound belief in the provision of a lighting service of similar standard in their areas—in the home, shop, office or factory.

Glasgow Municipal Buildings

Correct procedure, particularly in the early stages, is all-important, as is evidenced by the following comments from Troughton & Young, Ltd. "In the early stages of the job we endeavour to get into touch with the architects, and are often approached by them, to discuss methods of lighting appropriate to the design and purpose and the particular positions available. Preliminary suggestions are formulated and indicated on the plans and where lighting equipment is incorporated in the architecture itself rough full-size sketches are made to ensure that the suggestions are practical. Special fittings are evolved as the result of considerable discussion from both the æsthetic and architectural points of view and also in accordance with the technical requirements of illumination and wattages which affect not only the design and shape of the fitting, but also its bulk.

"For final settlement full-size details are worked out and very often complete full-size working drawings for submission to the consulting engineer and others concerned. Where wattages and other details are not worked out by the consulting engineer or in instances where no electrical consulting engineer has been appointed we check up to ensure that sufficient wattages are allowed and that the design of the fittings and the glazing is both efficient and æsthetically satisfactory."

G.V.D. Illuminators, Ltd., stress how important it is for the architect to call in the lighting expert at the earliest possible stage, as it is necessary for the latter to know what particular effects are desired, so that he can calculate what space he will need, co-operate intelligently with the architect and enable the latter to adapt his plans where necessary, so as to ensure that the desired lighting effects may be obtained as conveniently and as economically as possible.

Holophane, Ltd., find assistance in meeting the problems presented to them by regarding municipal buildings under two main headings—those in which some antique fittings have to be preserved and must be utilised as part of the new lighting scheme, and those in which a completely new lighting and wiring scheme is being installed. An excellent example of an installation of the former kind is that at the Oxford Town Hall where "Ripplelite" bowls have been adapted to fit into the ring fittings already existing.

Although the G.E.C. pays first importance to the treatment of architectural features and cites the City of London Guildhall, York Guildhall, Westminster City Hall and Manchester City Hall as having lighting appointments of a very high order which contribute largely to the decorative effects obtained by revealing architectural features and mural decorations, it is prone to regard the wider problem as one involving separate treatment for different classes of lighting for, say, main entrances, vestibules, corridors, assembly halls and council chambers. To some extent this is because municipal dignitaries and officials often concentrate their pride upon particular sections of their civic centres.

The council chambers in such town halls as those at Camberwell, Fulham, Kingston-upon-Thames, Luton, Burslem, Stoke and Gillingham are illuminated in various ways. There are laylighting and cornice lighting at Camberwell and Gillingham, a large laylight and concealed lighting behind the wainscoting at Luton, visible lighting fittings only at Kingston-upon-Thames, and visible lighting fittings with laylights at Stoke-on-Trent. In the new Manchester City Hall all the lighting fittings in the council chamber are arranged for indirect illumination from wall brackets of 28 in. and 24 in. diameter. The lighting of the large public halls of most of these buildings is effected by specially designed fittings the metalwork of which is, in the main, of bronze, the glazing being of flashed opal. Entrances, vestibules, staircases and corridors respond well to various forms of lighting and no two are exactly alike. The main entrance lighting at Grimsby, Kingston and Luton is carried out on very dignified lines and the lighting fittings harmonise well with the surroundings.

Adapted antique fittings in Oxford Town Hall

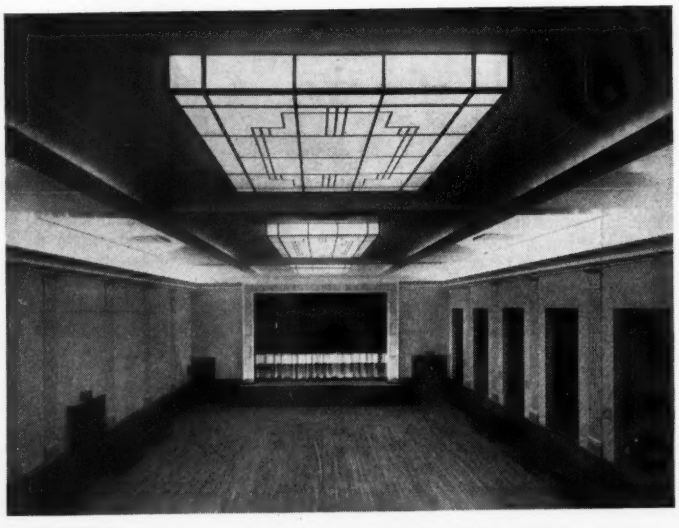
As an outstanding example of staircase lighting Troughton & Young mention the tier-type panel fittings which surmount and grace the staircase pillars at the Hackney Town Hall, whereas for main hall lighting they direct attention to the massive pendant in the Leeds University Library Building. A bracket produced by Best & Lloyd, Ltd., for the Bolton Civic

Massive pendant in Leeds University Library

Centre is of interesting design. It embodies a metal bowl inside which is an adjustable mirror for indirect lighting. The flashed opal cylinder provides a direct lighting element which livens up the general effect.

No form of illumination adds more dignity and impression of stability to a civic building than architectural lighting built into the structure and blending with the general decorative scheme, say G.V.D. Illuminations, Ltd., who claim that by their methods even and ample illumination at a saving in installation and running costs, often as much as 75 per cent. can be obtained over other methods. The reflecting arrangements can be adapted to a great variety of circumstances, so that æsthetically effective, technically efficient and economical illumination can usually be provided in practically any desired form to harmonise with the architectural style or purpose of the building, the decorative features and any proposed furnishing scheme.

The laylight is claimed to be one of the simplest and most effective devices for filling every corner of a room with evenly diffused light, but with the older methods it has often been necessary to arrange a large number of lamps immediately above the glass, so that a dense, heavily diffusing type of glass has had to be used in order to minimise the spotty effect and avoid glare, with consequent disadvantages. By the new method it is possible to light almost any laylight with one, two or at the most four lamps to evenly spread their light over a very light diffusing glass.



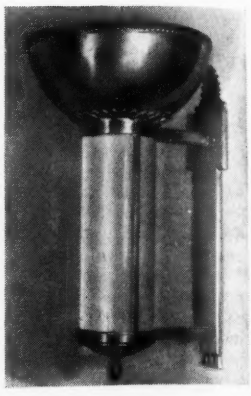
Cornice and laylighting in Dukinfield Jubilee Hall

The only illumination in the new council chamber of the Runcorn U.D.C. is from an artificial laylight measuring 11 ft. by 8 ft. and placed in the centre of the slightly curved ceiling. It is equipped with four lamps only. The Dukinfield Jubilee Hall is illuminated by a combination of cornice and laylighting with full provison for colour change effects. The ceiling is divided into nine panels by coved beams, the centre three being occupied by suspended laylights, each with ten combinations of colour lighting which scintillate across the room through the cross-reeded glass with which they are glazed.

In offering the following suggestions as being specially suitable for various types of civic building lighting the company stresses that they need no longer be considered as expensive or exceptional luxuries. Artificial windows on the same walls as the real windows, but between the latter, so that the general direction and the main lighting is similar, are often the best way of providing artificial illumination similar to daylight. A panel, say, 6 in. to 9 in. wide and anything from 3 ft. to 12 ft. long can be evenly lighted throughout its length by a single lamp. An extension of this principle provides a luminous frieze round the four walls of a room or, say, a luminous glass pelmet. It is now possible to provide much more even and effective cornice lighting with far fewer lamps and to further project the light horizontally to illuminate the whole ceiling fairly evenly.

Further suggestions are curtain lighting in which concealed lighting is thrown obliquely down the curtains to emphasise their beauty of texture; luminous grilles for breaking up the monotony of a wall and behind which decorative figures can be placed; illuminated frames for doorways and archways; and luminous pillars and beams.

Holophane, Ltd., keep an eye on those upon whom devolves the selection of fittings. They find that where council members or officials are responsible for the choice of fittings the tendency is to choose large ornate fittings of the cluster or similar types which make an imposing show. Where the architect has full control of the building there is a tendency to the use of "streamlined" or "built-in" fittings. The company believes the future of civic centre lighting lies in "built-in" lighting because of its unobtrusiveness and high efficiency. At the Colston Hall, Bristol, there is an example of how "built-in" lighting can be applied to an old type of building, the huge ceiling clusters and wall brackets having been removed.



Bracket fitting at Bolton Civic Centre

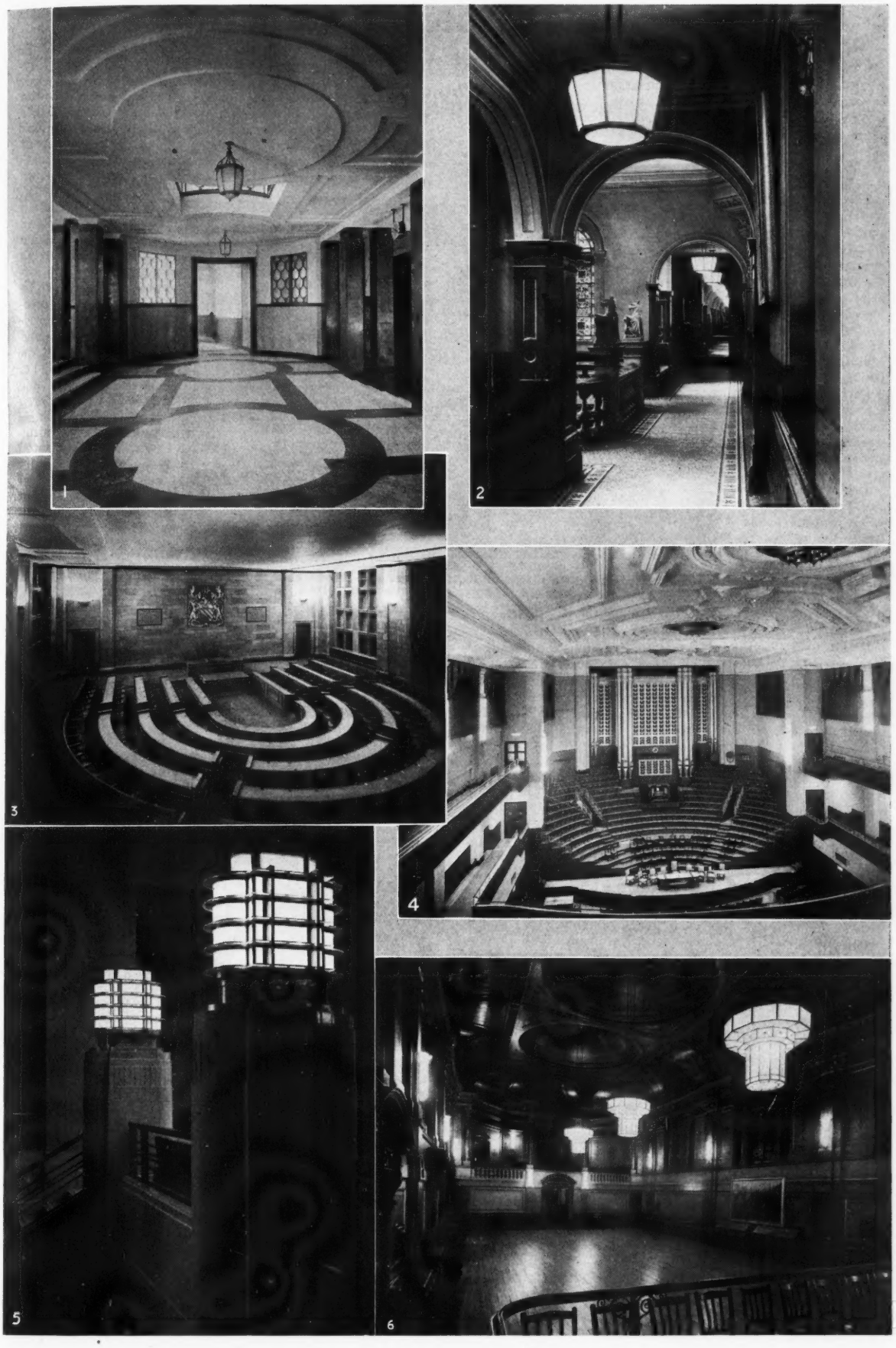
The company points also to an indication that colour lighting is receiving attention for town halls where dancing and receptions are a feature. The colour lighting scheme should be separate from the white lighting and capable of operation alone or in conjunction with white lighting for special effects.

Further support of the contention that the lighting of to-day is comparable in importance with the architectural, mural and other decorative features is found in the many fine examples of the revealing effects of external architectural features by floodlighting of civic centres. We select for illustration the Glasgow Municipal Buildings and Barnsley Town Hall, both of which are illuminated by means of "Mazdalux" projectors (British Thomson-Houston Co., Ltd.).

Loan Repayment Periods

IN response to representations made by the I.M.E.A., the Conference of Joint Electricity Authorities, etc., and the Institute of Municipal Treasurers and Accountants, the Electricity Commissioners have decided to extend the maximum period for the repayment of loans for certain apparatus. As regards electric cookers the period will be extended from seven to ten years, while the period for loans in respect of all types of AC meters which are capable of ascertaining the value of the supply within the prescribed limits of error at the standard low pressure of 230 V and the corresponding medium pressures (400 or 460 V) is to be raised from ten to fifteen years. The repayment period for all other types of AC meters and for DC meters will remain at ten years. With regard to washboilers and water heaters the Commissioners are collecting further information. These decisions will apply only to expenditure incurred on and after January 1st, but arrangements will be made in appropriate cases for adjustment (where so desired) of the repayment periods of unspent balances of sanctions already held for cookers and AC meters.

In reporting this matter to the London and Home Counties J.E.A., the Authority's Finance Committee stated that the recently adopted estimates for 1939 anticipated the extension of the repayment period for cookers. A saving of £935 would be effected in 1939 by the extension of the loan repayment for meters with an accumulated saving year by year. Had the extended periods been applied to the undertaking from January 1st, 1931, there would have been a saving of £110,000.



Examples of lighting fittings and methods in municipal buildings

1. Vestibule lighting at Kingston-upon-Thames Guildhall. 2. Corridor lighting at Grimsby Town Hall. 3. The Council Chamber, Manchester City Hall. 4. Colston Hall, Bristol. 5. Staircase lighting at Hackney Town Hall. 6. The large public hall at Fulham

A Seaside Hotel Installation

Effective use of cornice lighting

TO obtain the most effective results in cornice lighting installations it is essential to secure co-operation between the architect, the electrical contractor and the lighting specialist. This fact has been appreciated at the new Ocean Hotel at Saltdean and to a large extent, therefore, the cornices have been designed to suit the requirements of reflectors made specially for the purpose of the Phœnix Electrical Co. (Ldn.), Ltd., by Allom Bros.

This system of illumination has been adopted in all the principal public rooms and, perhaps, the most successful arrangement is to be found in the café and ballroom, particularly in the former where reflectors with 100-W lamps spaced at 2 ft. 9 in. centres produce a remarkably even distribution of light without any appreciable spotting. The resulting efficiencies are gratifying since the ceilings are not of a helpful colour from the point of view of reflection. Average intensities of about 10 ft.-candles have been obtained, the electricity consumption being considerably less than would have been the case if the usual system of continuous lamps had been employed. Taking into consideration the saving of lamps, the maintenance costs of the installation are likely to prove surprisingly small for a cornice lighting scheme.

A remarkably even distribution of light without any appreciable spotting has been achieved in the ballroom of the new Ocean Hotel, Saltdean

Apart from the main general illumination from the cornices, a number of other lighting effects have been introduced for special purposes. In the ballroom the decorators, Mendenhall, Ltd., have supplied some specially designed wrought-iron pendant fittings constructed in two tiers with peach coloured glass. Revolving hemispherical mirrors incorporated produce a scintillating effect on the dancers when spotlights are trained on them. A Strand dimmer controls the ballroom lighting.

The terrace outside the ballroom is floodlighted by Benjamin units as are also the swimming and paddling pools. In the case of the pools six 1,500-W and four 1,000-W lamps are mounted either on the top of the surrounding blocks of the hotel or on poles at the corners, switching being effected by means of contactors operated by push-buttons in the changing rooms. Provision is also made for floodlighting the tennis courts and gardens. A three-colour illumination system produces a striking effect for a cascade, while a small pond in front of the hotel entrance has the spray from one of the new Graham Farish fountains illuminated by Wardle watertight fittings round the edges. Neon signs have also been installed.

For the general illumination of the corridors, &c., wholly enclosed ceiling fittings have been supplied by C. M. Churchouse who were also responsible for neat units fitted in the bedrooms. Lay-lighting by means of Benjamin reflectors is used in the lounge, and special two-tier ceiling fittings and wall brackets are to be seen in the billiards room, while lighting the main stairway there is a novel unit comprising three separate circular pendant fittings, one at each floor level mounted on a single tubular support.

The lighting throughout the building is controlled from a central board (F. H. Pride) situated in the reception office, Sangamo time switches permitting the corridor and exterior lighting to be switched off automatically: the corridor lights are wired alternately on different circuits. Each of the bedrooms is fitted with a Berry inset fire, and aquaria built into the dining-room walls are heated by thermostatically controlled electrical units. Adequate ventilation of the ballroom, café, billiard and changing rooms is secured by fans installed by G. N. Haden & Sons, Ltd.

The kitchens are well equipped with electrically operated food preparation appliances, including Crypto mixers, a potato peeler and mincer and a Magrini "Master Jiffy" steak griller. Dirty crockery can be dealt with at the rate of three thousand pieces an hour by a Dawson Bros. dish washer. A cold room, two refrigerators, a fish box and an ice-cream making apparatus have been supplied by the International Refrigerator Co., Ltd., which was also responsible for the refrigerators, beer and mineral water coolers and ice-cream apparatus used in the cocktail bar adjoining the ballroom. Automatic telephones (Anti-Static Installations, Ltd.), a public address system (Harley), synchronous clocks (Synchronome), direction signs (Linealux) and five lifts (Express), are other electrical features.

The Brighton Corporation has arranged for a 400-V three-phase supply to be given alternatively either from a local sub-station or from a ring main. In the intake room the main supply cables are taken direct to a distribution board of the Corporation's own design. On the left of this is the switchgear for the lighting and three-phase power, while on the right are the heating and single-phase power boards, the iron-clad gear used being M.E.M., E.E. and Sanders. Approximately 1,100 A is taken for lighting and 2,700 A for heating, three-phase power requiring about 200 A.

The electrical contractors for the installation, the Phœnix Electrical Co. (Ldn.), Ltd., have used G.E.C. conduits, Callender's armoured cable and mostly Craigpark v.i.r. cable. Tucker silent AC switches are installed throughout the hotel.

Municipal Supply Undertakings' Results

Town.	Engineer.	Total Revenue.		Working Expenses.		Net Profit.		Sales of Electricity.		
								Thousands of kWh.		Percentage Increase.
		1936/37.	1937/38.	1936/37.	1937/38.	1936/37.	1937/38.	1936/37.	1937/38.	
		£	£	£	£	£	£			
Accrington	A. W. Clegg	116,851	124,808	59,146	56,149	24,055	23,326	36,815	41,000	11.3
Bedford	R. W. L. Phillips	227,189	250,019	156,277	184,486	9,219	160	58,525	64,040	9.4
Bethnal Green	E. E. Jolly	125,596	133,897	75,151	85,363	23,003	21,269	16,226	18,078	11.4
Cannock	P. Wardle	65,419	69,116	41,222	46,102	6,365	5,644	10,085	13,196	30.8
Croydon	F. N. Rendell-Baker	516,552	545,700	140,034	170,001	40,251	70,347	112,484	118,957	5.7
Douglas	B. Kelly	72,497	81,276	42,371	49,229	3,138	5,060	8,063	9,389	16.4
Eccles	C. V. Johnson	74,175	81,310	48,467	56,099	12,590	11,715	13,220	15,593	17.9
Gillingham	H. Hall	97,419	101,179	76,663	89,531	2,032	*6,779**	21,022	20,715	*1.5*†
Halifax	G. A. Vowles	231,354	241,142	149,114	161,804	42,083	34,810	55,693	59,758	7.3
Harrogate	N. McLean	149,727	160,828	81,903	99,407	23,892	18,430	21,806	23,207	6.4
King's Lynn	C. W. Jackson	62,969	74,581	35,371	51,145	10,174	8,786	12,770	15,885	24.4
Mexborough	E. Andrews	30,529	31,542	20,485	23,041	3,053	468	3,563	3,973	11.5
Mountain Ash	G. W. Jones	21,637	23,105	17,309	19,553	*721**	1,063	2,347	2,589	10.3
Newark	R. E. Livesley	36,888	42,863	26,416	30,777	5,677	6,657	10,054	11,937	18.7
Norwich	V. A. Pask	481,181	498,477	320,312	352,851	42,706	21,253	74,188	82,538	11.3
Stepney	A. E. Campbell	530,245	558,308	338,338	368,382	27,802	8,485	98,083	105,208	7.2
Weymouth	G. Nicholson	75,682	77,957	41,484	51,322	13,241	7,870	12,510	14,121	12.9
Wimbledon	A. E. McKenzie	328,764	390,189	204,917	267,645	35,273	20,471	68,852	76,297	10.8

* Net loss. † Decrease.

Organisations of the Industry—III

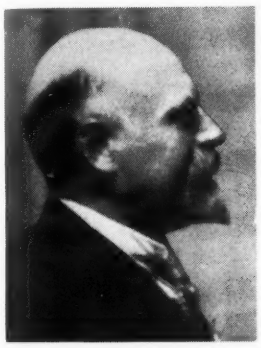
The Electrical Contractors' Association

By L. C. Penwill, Companion I.E.E., Director and Secretary

WITHIN an article of reasonable length it is far from easy to give a connected summary of the long history of the E.C.A. and its Allied Associations. The Electrical Contractors' Association (Incorporated) dates from 1904 and claims to be the oldest trade organisation within the British electrical industry. This date, however, does not represent the commencement of electrical contractor organisation in this country because the installation trade was served by the old National Electrical Contractors' Association from 1901 up to the date of its change of name and incorporation by the Board of Trade.

Even so, "E.C.A." records extend to an earlier date than this. For several years prior to 1901 many local bodies of organised contractors were in existence in London and the Provinces, and in Scotland and Ireland, the establishment of the national body in 1901 representing a general recognition of the fact that local bodies were necessarily limited in scope, and that national organisation was necessary if real progress was to be made. To this end a national meeting was called at Andertons' Hotel, London, in 1901, the rather noisy assembly (as it was reported) being presided over by a cordially supporting, but none-the-less independent, chairman in the person of the late Mr. Henry Alabaster of the ELECTRICAL REVIEW. Old E.C.A. men remember this fact with great satisfaction because, all through its long history, the REVIEW, in common with the trade Press as a whole, has always been prepared to support the Association no matter where the "big battalions" might happen to be drawn up at the time.

The electrical contractor is an important link between the electricity supply authority and the consumer, as well as between the manufacturer and the public. In his intermediate position he was one of the first to see the need for organisation in the electrical industry. This article tells the story of the Association's beginning and subsequent development.



[*Elec. Rev. photo.*
Mr. Walter Riggs, M.I.E.E., this year's President of the E.C.A. and Allied Associations

As a simple paradox, of course, the antiquity of the E.C.A. is strictly in keeping with the extreme youth of the electrical industry itself. When one tries to review the industry as it was forty years ago, and then takes a glance at its giant proportions of to-day, it is difficult to realise that all this development has taken place within the lifetime of men who continue to be active at the present time. More than forty years ago, for example, Mr. W. R. Rawlings, A.M.I.E.E. (E.C.A. President in 1904, 1914 and 1931) was an extremely live member, and repeatedly chairman of the London Branch. In spite of this very early start, however, "Mr. W. R." is very much with us at the present day, his robust figure and sage advice being available on all major E.C.A. occasions. And not only on E.C.A. occasions, because Mr. Rawlings has a proud record of long service to the electrical industry as a whole.

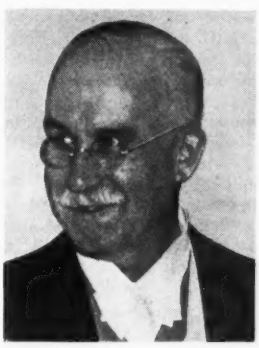
Take another thought-compelling glance at the past. In the first issue (May, 1903) of the E.C.A. official journal, the *Electrical Contractor*, the very first article to be published was devoted to "piece work" and was written by Mr. R. G. Tyler, M.I.E.E., who, to this day, continues an active member of the E.C.A. London Branch. In view of later E.C.A. developments—which will be outlined in due course—that particular article is of more than passing interest. Mr. Tyler regarded "piece work" as "rush work," and because installation work was largely hidden work he resolutely opposed the idea of "payment by results." He regarded the safety of good work as being of far greater importance than its cost—and this, be it remembered, was in the old DC days of 35 years ago.

[*Elec. Rev. photo.*
Mr. L. C. Penwill, Director and Secretary of the Association

In that early—indeed, *first*—E.C.A. article, an indication was obtained of the clear policy that has animated the Association from its very inception. Within the limits of one sentence, the sole purpose of the Electrical Contractors' Association has been to raise the technical and commercial status of installation engineers, to protect the trade against all types of unfair and dishonest competition, and to promote the friendly unity of all sections of the industry in the common cause of sound electrical development and effective public service.

Following the establishment of the E.C.A. (Incorporated) in 1904, two striking developments took place in 1916. It is well enough known that an incorporated body is required to work for the general good of the community it represents and is not permitted to trade for the commercial advantage of its constituents. This limitation of function carries with it certain legal advantages of considerable value to such a body as the E.C.A.; but, in 1916, the Association realised that allied bodies must be formed if the organisation was to work to the full advantage of all concerned. In the year mentioned, therefore, E.C.A. members promoted the N.E.C.T.A., Ltd., and the National Federated Electrical Association (N.F.E.A.) which was registered as a trade union.

The mutually supporting strength of this triple organisation is, of course, apparent. With its legal and Parliamentary standing, the E.C.A. is in the best possible position to represent the interests of the installation trade as a whole. On the other hand, N.E.C.T.A. as a limited company, can trade in any way that is deemed to be to the personal interest of members; while, from the employers' point of view, the Federated Association can deal with all labour matters on level terms with its trade union operatives or employés. The Council of the E.C.A. also happens to be the board of directors of N.E.C.T.A., Ltd., and the national executive of the N.F.E.A., the triple organisation in question being entirely unique in electrical trading history. Indeed, it is not known that a similar triple organisation exists in any other branch of British commercial enterprise.



[*Elec. Rev. photo.*
Mr. W. R. Rawlings, the first President of the incorporated Association, has occupied the position in two subsequent years

At this juncture in electrical trading history there is no need to dwell on the Association's early fighting days. In years gone by, "individualism" was a characteristic national creed, and was very much in evidence in an infant industry attempting to run before it could walk. Comparatively minor differences of opinion were magnified into enemy actions which were only to be restrained by force.

But times have changed and it is desirable to dismiss many years of strenuous E.C.A. activity designed to compel opponents to recognise a particular point of view. In this matter it was truly remarked some little time ago that the E.C.A. harbours no bitter memories at all. The association has fought and won, and fought and lost, and is all the better for both experiences.

This necessarily brief glance at the work of a great trade organisation achieves much calmer waters by dwelling on the constructive work undertaken by the E.C.A. on behalf of installation trade enterprise, integrity and fair trading. Under the first heading it is to be noted that the Association was an early and cordial supporter of the Electrical Development Association when that body represented all sections of the industry rather than the supply authorities alone. The E.C.A. contributed liberally to the general and special campaign funds of E.D.A. and one of our

past-presidents, Mr. Howard Marryat, M.I.E.E., served as chairman of E.D.A. during a particularly active year. It may also be noted in passing that Mr. Marryat has also acted as president of the E.I.B.A. and that he achieved an outstanding development of that Association's financial position during his year of office.

Under the second heading the E.C.A. is proud of the fact that one of its old members, Mr. H. T. Young, M.I.E.E., won the electrical industry's highest honour when he achieved the presidency of the Institution of Electrical Engineers: while, for solid work on behalf of installation security, it is entitled to derive great satisfaction from the long service of its members who have served on the Wiring Regulations Committee of the same Institution. An E.C.A. past-president, Mr. H. J. Cash, M.I.E.E., has worked unselfishly in the cause of sound installation practice and has been rewarded (or burdened as the case may be) with the vice-chairmanship of the important Institution Committee already mentioned. In the same way, many able E.C.A. members have served their industry as chairmen of I.E.E. Local Centres, two recent names in this category being provided by Mr. E. A. Reynolds, M.A., M.I.E.E., of Birmingham (vice-president, E.C.A.) and Mr. J. Gaunt Craven, M.I.E.E., of Leeds.

In the formation of the National Register of Electrical Installation Contractors the E.C.A. played a major part in the reorganisation of the installation trade. For many years' past the E.C.A. has advocated the principle of compulsory registration—and, indeed, continues to do so at the present day—but in 1924 gladly accepted the powerful assistance of the I.E.E. in setting up the voluntary N.R.E.I.C. as a first step to this earnestly-desired compulsory end. At the present day the E.C.A. gives whole-hearted support to the National Register and welcomes the additional support now forthcoming from the Association of Supervising Electrical Engineers and from the Inter-Associations Committee under the chairmanship of Mr. S. B. Donkin, M.Inst.C.E., set up to further the basic principle of compulsory registration.

Fair Trading

Coming now to the last item, namely, Fair Trading, in this section of constructive work for the better organisation of the electrical industry the efforts of the Association stand supreme. In actual fact the E.C.A. produced the first Fair Trading Policy to be seen within the four walls of the British electrical industry. The document in question was produced in 1922 and was extremely useful in regulating disputes and in persuading the industry as a whole to recognise that trading by agreed rules was far more sensible than trading under no rules whatever. Once again, this effort represented a practical attempt to set up law and order in place of chaos.

In due course the E.C.A. Fair Trading Policy was developed into something better. As a consequence of the active negotiations that took place prior to the passing of the 1926 Electricity (Supply) Act—a work in which "Committee D" took an active part—a Fair Trading Committee representing all sections of the electrical industry was set up under the chairmanship of Mr. F. W. Purse, M.I.E.E., and the Electrical Fair Trading Policy as it is known to-day was duly evolved. Ultimately, of course, the Fair Trading Council was brought into being in order to administer, amend and develop this Policy as and when the need arose; but, and most unfortunately, the supply interests—company and municipal alike—have not as yet seen their way to serve on this natural outcome of the original Fair Trading Committee. Strange as it may seem, the supply authorities gave their aid in framing the policy, but now stand aloof from the accomplished fact.

So far little direct reference has been made to the activities of N.E.C.T.A., but it will be apparent that the work of this limited company is in a sense the private concern of its individual members. N.E.C.T.A. is able to enter into trading agreements with other organised sections of the industry to the direct advantage of all concerned, and is equally in a position to negotiate insurance and other financial benefits for all its members. In some of N.E.C.T.A.'s insurance work, for example, a block policy covers the entire membership by one centralised payment, while other specially negotiated insurance policies are substantially more comprehensive than can be obtained in the open market. In the direction of organising hire-purchase and similar arrangements the N.E.C.T.A. holds a very strong financial position, and in many other directions the work of this limited company endows its membership with very important material benefits.

Educational Work

Since the earliest days the E.C.A. has taken a very keen interest in the technical education of its members' apprentices. The principle of indentured apprenticeship has been strongly supported, the closest possible co-operation has been maintained with the City and Guilds of London Institute, and E.C.A. gold, silver and bronze medals and money awards (upwards of £100 per annum) have been given every year to successful apprentices in the City and Guilds examinations. For many years now, past-presidents of the E.C.A. have been installation "examiners" to the City and Guilds, the present holder of that office being Mr. A. G. Bruty, M.I.E.E., of Dublin. At the same time constant contact has been maintained between the National Federated Electrical Association and the Electrical Trades Union; and, in these difficult times, it is sufficient to say that labour peace—and the benefits of peace—have been successfully maintained in the electrical installation industry for many years past.

It remains to be said, perhaps, that the Electrical Contractors' Association (Incorporated) and its Allied Associations are wholly democratic in their general organisation. The Association comprises 80 branches and sub-branches in England and Wales, Northern Ireland and the Irish Free State—Scotland maintaining an independent organisation in the shape of the E.C.A. of Scotland. At the present moment the membership of the E.C.A. (Incorporated) is approaching a figure of 2,000. Members assembled in their respective branches send forward representatives to their appropriate Sectional Boards, and from these assemblies members are elected to serve on the E.C.A. Council. The Council itself is presided over by the President for the time being—this year's President being Mr. Walter Riggs, M.I.E.E.—while a smaller Executive Committee of the Council under the chairmanship of Mr. W. H. Walton, carries on the more detailed business of the Association.

All-electric Restaurant at Chester

ONE of the most up-to-date restaurants and ballrooms in the country was recently opened at Chester, when the well-known "Quaintways" restaurant was transferred to a new and larger building on an adjacent site. The restaurant is replete with labour-saving devices, air-conditioned throughout, and heated under thermostatic control, while telephonic intercommunication is provided.

The principal electrical interest is in the kitchen, three still-rooms and bakehouse, in which electrical equipment is used exclusively. The whole of the cooking and baking equipment was manufactured and supplied by the General Electric Co., Ltd., and was specially designed with a pleasing green vitreous enamel finish to harmonise with the decorations. The electric kitchen equipment comprises a chef's range, boiling table, cabinet roasting oven, stockpot, table grill, griller-toasters, pressure griller, fish fryer, hot cupboard, and steaming oven, while four hot cupboards, griller toasters, and boiling plates are installed in the still-rooms, the whole being designed to cater for 600 people.

The most conspicuous feature of the kitchen is the island section formed by the chef's range, boiling table and hot cupboard, which are grouped together. The chef's range is a two-oven range of new pattern, measuring 7 ft. by 3 ft. by 2 ft. 6 in. overall. It is fitted with a special simmering hob embodying high temperature hotplates, two circular plates (17 in. and 12 in. in diameter) being provided over the left-hand oven and a rectangular plate (24 in. by 16 in.) over the right-hand oven: in addition, each hob has four small circular plates mounted under the hob plate, thus making the whole of the hob a convenient simmering area. The boiling table is of the same overall dimensions as the range and is equipped with a similar set of hotplates. Suitable pot racks are provided at a convenient height above the range and the boiling table. Special features are incorporated in the two-pan fish fryer, which is arranged so that thermostatic control can be brought into use at a later date, and in two large hot cupboards, which have electrically heated plate racks above.

A variety of electric baking equipment is installed for the production of light confectionery. The main items are a single-deck peel oven for plain goods, a double deck oven the upper deck of which is used for special confections, a scone plate for girdle cakes and the like, and a chocolate dipper with the usual thermostatic control and having a spare pan for fondants. The exterior of the premises is floodlighted by G.E.C. projectors, using "Osram" lamps, and G.E.C. dimmers are installed to give lighting control and colour changing effects in the ballroom and on the stage. The 400-V three-phase AC supply is obtained from the Chester Corporation. The installation work was carried out by the Chester Corporation Electricity Department under the supervision of Mr. S. E. Britton, the borough electrical engineer. The total installed electrical load is 497 kW.

At the recent dinner to celebrate the re-opening of the restaurant Mr. S. E. Britton said he believed that from an electrical standpoint "Quaintways" was unique. Mr. Dudley Beck, the principal of "Quaintways," mentioned that the original electrical plant had given every satisfaction and it was accordingly adopted for the extensions.

Credit and Prepayment Consumers

By G. O. McLean, M.Eng.

Their relative numbers and methods of charging for their supply

JUDGING from the contents of some reports by supply engineers which were published during the summer one topic which is forward nowadays is the growing demand for prepayment meters. Thinking that the sundry reports perused may have been fortuitously one side of a picture only, I recently made some inquiries of meter manufacturers regarding the relative demands for quarterly and prepayment meters. It may be a surprise to some readers to hear that the manufacturers' figures over the last year show that as much as 60 per cent. of all house service meters sold were of the prepayment type. This provided food for serious thought, and the answers evoked by a few judicious questions and the subsequent analysis may be of some use to others.

In reply to a leading question "Why do you want (or have) a slot meter!" the answers are varied, such as: "Oh! I like to pay as I go"; "Well, you see, I get my wages every Friday, and not every quarter"; "Our last house was gas, and that was penny in the slot"; "I can't afford your deposit"; and "Well, look what I get back when your man comes round."

Each of these answers presents a different psychological aspect, and each deserves some consideration if the supply industry is to fulfil its trusteeship and render service to the public adequately. The first one with its stress on the "like" evidently implies "dislike" for credit, even although the latter may be allowed for consumers' and producers' mutual advantage. The second one may be a frank admission of inability or disinclination to save the necessary weekly sum for the service received. Both, however, are absolutely valid reasons which brook no argument, and such consumers surely deserve encouragement. Do they always get it? For instance, can a consumer get a slot meter as easily as a quarterly meter? Is there not a school of thought which tries to reduce the number of prepayment consumers and adopts various direct and indirect deterrent methods, the usual reason given for such actions being that slot meters are more expensive and pilfering more rife?

The author maintains that much of the success of the gas industry has been due to the use of slot meters and this has made the public "slot-meter minded." He also questions the wisdom of demanding deposits from consumers.

One hardly dares to mention Section 20 of the 1882 Act, but some of the differences between "credit" and "prepayment" consumers may be somewhat near "undue preference" between classes of consumers, though the safeguard is for consumers in the same class. For instance, there are many undertakings having a different (higher) flat rate for slot consumers than for credit consumers, or (a variant of the same thing) the credit consumers have a sliding scale, and the prepayment consumers a fixed one. Again, how many prepayment consumers get a prompt-payment discount, which for some credit consumers is as high as 10 per cent.? That they do get "some money back" is evidenced by one of the consumer's answers, but that is a rebate and not a discount.

Gas Industry's Example

To return to our question and answers, however, the third answer gives another good reason for encouraging the prepayment consumer, and one that the author thinks has been overlooked—namely, the opportunity for selling more electricity. This is one of the many leaves we should have taken out of the gas industry's book (let us admit that their salesmanship is good) and have apparently overlooked or ignored. Our competitors realised that the simplicity of putting pennies in the slot as and when required without having to worry about an account helped to make people gas-minded, and also perhaps kept the average consumer ignorant of the total amount he was spending on the service per annum. It is surely because they were encouraged by the management that the majority of gas consumers have slot meters. Estimates about the ratio of slot to simple measurement meters in the gas industry appear to vary from 70 to 90 per cent., depending on local conditions.

Though no figures appear to be published for the electrical industry, it is doubtful if the ratio (at present) is higher than 30 per cent. Now that domestic electrification is really taking a hold upon the weekly wage-earning class, this figure is rapidly increasing, as is evidenced by the meter manufacturers' sales. The point to be stressed, however, is that the good habits formed by the gas industry of putting pennies in the slot for domestic service should be allowed to continue and turned to better account by our salesmen, pointing out how fewer pennies have to be put in for the same service, or the increased and superior facilities in the home for the same number of pennies.

Should Deposits be Demanded?

The fourth answer may sound unreasonable to some ears, but it is a sore point with more consumers than many supply managers imagine. The only part of the "grouse" that is voiced may be that "the deposit is more than I had to pay at the last place," but nevertheless "had to pay" shows resentment at having to make any deposit. While aware that some progressive undertakings have dispensed with deposits, it still appears to be general practice in the electrical industry (though again not half so prevalent in the gas industry) to demand deposits. There does not appear to be any record of the amounts of deposits required by the various undertakings.

Having been connected with a "no deposit" and a "small deposit" undertaking, the author delved into the question of the worthwhileness or otherwise of deposits, and his findings may be of use or interest, or perhaps surprising to others.

From the Commissioners' Returns it will be seen that total annual revenue is roughly £10 per consumer, and by making allowances for large commercial consumers it is safe to assume that the revenue from the average *domestic* consumer is approximately £8 per annum or £2 per quarter. If this figure is demanded as security, then for each 100 credit consumers the supply authority has £200 to invest. As the actual amount invested is somewhat less, in order to keep the account fluid, the interest earned is between 2½ and 3 per cent. By Section 71 of the 1899 Clauses Act, however, the consumer must receive 4 per cent. on the amount of his security; and so for each 100 credit consumers the supply authority loses at least £2 per annum, and in "invisible" expenditure there is the clerical work involved in explaining the system, collecting the deposits, crediting interest quarterly or annually, refunding deposits, and the accountancy work in connection with the deposit fund, all of which for a normal-sized undertaking serving 30/50,000 consumers can be roughly assessed at a further £2 per 100 consumers.

Few Defaulters

The total £4 costs, when compared with the £800 revenue, appears to be a small item, being only 1 in 200, or something more than 1d. in the pound, but what is its justification? Suppose the stock answer of "It provides security," or "It keeps down bad debts" are examined closely. Apart from bankruptcies (which are negligible) the security or bad-debt safeguard is against absconders or flitting tenants, but how many domestic consumers *do* move in a year It depends on the class of people and their occupation, and investigation shows that the numbers vary from 5 per cent. to as much as 20 per cent. in some of the London boroughs. Much of this moving is done from one house to another in the same borough, or is done openly after due notice has been given; in fact, only about 5 per cent. of the movers can keep their movements secret.

The number of defaulters, then, can only be from 0.25 to 1 per cent. of the total number of credit consumers. It is inconceivable that all the defaulting will be done on quarter day (though it must be admitted that defaulting may be attempted because indebtedness is high), so that an average of 75 per cent. indebtedness, *i.e.*, £1.5 per defaulter can be assumed. The total bad debts loss will then be from £0.375 to £1.5 per 100 credit consumers, or per £800 revenue, which is considerably less than the costs under the deposit system.

The criticism against the reasoning outlined above is likely to be that, even if only 5 per cent. of the movers succeed in keeping their movements secret, many more would attempt to abscond if there were no deposit, and the recovery costs may be considerable. Surely, however, the reply to such criticism is (1) that even if 50 per cent. attempt default, that is only 2½ to 10 per cent. of the total, which means considerably less clerical and book-keeping work, and also implies that 90 to 97½ per cent. of the total have this one particular grouse removed, and (2) that the costs are recoverable from the defaulter, and also if the following-up were done promptly and efficiently the final number escaping, whose debts would be

really "bad," would be nearer 2 per cent. than 5 per cent. The final "proof of the pudding," of course, is comparison between undertakings using the two opposite policies of "no deposits" and "deposits without exception," though, as pointed out earlier, there are no tabulated records.

True comparison, it should be pointed out, must not stop at accounts figures of bad debts and interest losses, but should take account of goodwill between the supply authority and its consumers, and "invisible" items such as those hidden in "management" expenditure.

If this digression were not already so long, one would be tempted to discuss management costs as a percentage of total expenditure or revenue in relation to numbers of prepayment consumers, but it is time to return to our original question, and say again that the demand for a deposit does frighten many people off electricity, making them think electricity is an expensive luxury, and they immediately ask "Can't we have a slot meter?"

Of the five typical answers to the question cited, the last one exposes the deepest psychological factor. It is not a new phenomenon, of course, that people like rebates and dividends, obtained in periodical lump sums by overpaying fractional amounts on day-to-day purchases; the main point to be stressed is that the overcharge, if deliberate, must be a small fraction, so that even the nominal price, *i.e.*, the real price plus the overcharge, is competitive with other forms of energy, and encourages the increased use of electricity through the adoption of other labour-saving appliances. While I do not advocate the increased use of prepayment meters in order to satisfy this predilection, or even where such meters are installed to consistently overcharge, such a practice does afford immense "consumer satisfaction," and is, of course, most helpful to the supply authority at times of tariff changes.

The tendency up to the present has been for unit charges to fall, and therefore rebates have increased or been created instead of meters being altered. (It would be interesting to hear whether the practice actually originated thus.) Where the charge has to be increased, as has been the case in one or two instances, the existence of an overcharge simplifies the procedure enormously, as the changes are effected clerically and not manually "*in situ*" with the complications of finding enough skilled labour to make the changes in the minimum time and arranging convenient times with consumers. The principal counter-argument against the practice is that it entails additional clerical work, and if the abolition of such work is used as an argument in favour of prepayment *versus* credit consumers, it must be given serious consideration.

One cannot leave the subject of prepayment and credit consumers without a word about the refinement of the "straight slot" into a "two-part tariff slot" meter. The ordinary two-part tariff needs no championing, though "tariffs" in general is one of the most controversial subjects, and it would appear logical to apply the same principles to prepayment meters. The consumer who desires a slot meter does not enthuse over or readily grasp the idea of the "two-part slot," especially when, after one or two weeks' holiday, he has to put in several shillings before anything happens.

Mr. D. Bellamy, general manager at Hull, some months ago* gave details of the application of the two-part tariff through "straight slot" meters. Since the fixed charge, hiring charges and standard unit charge for an average prepayment consumer, when totalled and divided by the number of units consumed, came to from 0.9d. to 2d., a straight slot meter geared for a unit charge slightly in excess of the expected "overall unit charge," would give both consumer and undertaking complete satisfaction. This example shows that whereas the demand for a slot meter does mean a meter costing roughly two-and-a-half times the price of a quarterly meter, it is unnecessary to go still further and install one costing nearly three-and-a-half times as much, which is not appreciated by the consumer and also adds to the maintenance costs of the authority's meter department.

* E.D.A. Sales Conference, 1938.

A Colliery Winder

Many special features

THOUGH designed for its ultimate duty, an electric winder recently installed for B.A. Collieries, Ltd., Bestwood, near Mansfield, Notts, has temporarily been arranged to work a single "hoppit" (a type of cage) for assisting in the sinking of an additional shaft, known as the Calverton, which is expected to reach a depth of 1,800 ft.

For this purpose a special drum has been fitted, which, at 35.5 RPM provides a maximum rope speed of 1,050 ft. per min. This will be replaced when the shaft-sinking operations have been completed by cast-iron cones and a narrower grooved steel-plate drum, driven through double helical gears.

The motor rating is 525 HP at 3,300 V and 365 RPM; the 4.25 in. locked-coil rope will weigh 10,000 lb., the cage 5 tons, and the tubs 1 ton 9 cwt. each. In a normal winding cycle the starting peak approximates very nearly to the second peak reached at full speed.

Little braking will ordinarily be needed; nevertheless the electrical equipment has been designed for reverse current braking, as this will be required during the sinking operations. The mechanical brakes have been made to hold against the maximum torque of the motor and to meet the requirements of the new landing speed regulation. A valve, worked by a cam from the depth indicator, will prevent sudden full brake application during the full-speed part of the wind, the brakes being worked by an air engine supplied by a small compressor and controlled by "Iversen" gear. The same compressor supplies air for operating the reversing contactors controlling the main motor stator supply and also a servo-motor operating the liquid controller.

The forward and reverse direction contactors are both electrically and mechanically interlocked and are closed in the correct direction by a solenoid operated air valve. A further interlock between the two contactors is so arranged that the forward contactor cannot close unless the arc has been extinguished on the reverse contactor and *vice versa*. These contactors are equipped with blow-out coils and arc chutes.

The liquid controller ensures smooth regulation between creeping speed for rope inspection at moderate torques to full speed at full torque, and is designed also to permit power to be drawn from the supply for reverse current braking to stop the winder. This necessitated insulation for double the stand-still rotor voltage and called for some means of cooling the electrolyte, which is accomplished by circulating it down through each of the controller pots to the bottom and allowing the heated electrolyte to flow over a weir into a separate compartment, where the cooling is effected by a series of tubes through which cold water is circulated by an auxiliary pump driven by a 0.75 HP motor having a direct-to-line contactor starter. Overwind and overspeed protection is afforded by a model "C" Lilly controller with duplex governors and a safety lever on the driver's platform renders this action more sensitive when winding men. Additional protection against overwind is afforded by two special quick-break precision switches operated from the depth indicator. Automatic brake application results from the release of a solenoid acting on a floating lever in the brake control mechanism and a link is provided to reset this mechanically by putting the brake lever well past the "full on" position. Any overwind or overspeed trip or failure to reduce speed correctly opens the high-voltage oil circuit-breaker, the no-volt circuit being used as a safety circuit. The opening of the breaker removes all power from the winder and applies the brakes. The brake solenoid is controlled from the low-voltage side of the auxiliary transformer through a contactor whose coil is energised to remove the brakes. The driver has an emergency switch by which he is able to stop the winder at any time quite independently of his control levers. All apparatus is fully interlocked.

To enable the safety circuit to be completed to restart following any trip or overwind, cam-operated back-out switches are provided on the master controller, one to short-circuit the "Lilly" controller and final overwind limit switch in each direction. By connecting these switches to the correct overwind switches they make it impossible to restart the winder in the direction of the overwind. Once the main AC breaker has been closed the "controller off" position and "brake lever" interlocks are ineffective and will not open the main AC breaker when the controller and brake arm operate for winding. The stopping and starting of the air compressor motor is automatically controlled by an air pressure switch, and an automatic unloading solenoid is provided for starting.

The control gear has been designed to leave a clean floor at the winder level, all cables, pipes, control rods and shafts being in the basement, which houses the auxiliary equipment. The main switchboard is at winder level and close to the driver's platform in order to facilitate reclosing after a trip out. It consists of two 3.3-kV panels of the S.V.D. type. The incoming cable is taken to the bus-bars, one unit controlling the motor circuit, and the other a 10 kW step-down transformer which feeds the auxiliary plant.

The electrical equipment was made by the General Electric Co., Ltd., and the mechanical parts at this company's Fraser & Chalmers Engineering Works.

Designing Resistances.

By W. de Renzi, B.Sc.

In the following article the author explains the derivation from first principles of tables used in the design of resistances for DC starters and controllers.

NEWTON showed that the rate of cooling of a hot body is proportional to the difference in temperature between the hot body and the surrounding medium, and Preece's formula that the current-carrying capacity of a round wire in free air for a given temperature rise varies as $d^{\frac{3}{2}}$ (where d is the diameter of the wire) is merely another way of saying that for a given temperature rise the wire is capable of dissipating energy at a definite rate of so many watts per sq. in. of wire surface. The derived conception is linked up with Preece's formula as follows: $\frac{I^2R}{A} \propto T$ where I=current, R=resistance, A=surface area of the wire and T=the temperature rise; $\frac{I^2L}{A\,a} \propto T$ where L=length of the wire and a =cross-sectional area of the wire, since R is directly proportional to l and inversely proportional to a; $\frac{I^2L}{(d \times L)d^2} \propto T$ since A is proportional to $(d \times L)$ and a is proportional to d^2; $\frac{I^2}{d^3} \propto T$ and $I \propto d^{\frac{3}{2}}$ which is Preece's formula when T is constant.

Considering a length of the resistance wire having a unit surface area it is evident that Preece's formula and the conception derived from it are based on Newton's fundamental law of cooling. This conception is thus a convenient and correct basis on which to found tabular data.

In resistances used for starting with plain series control the different sections are in circuit for different times. The first section is in circuit during the time required to pass from the first to the second step of the controller while the last section is in circuit during the whole of the starting time. Between starts the earlier sections have longer times to cool than the later sections. As a result the watts per sq. in. which can be dissipated without exceeding the permissible temperature rise are higher on the earlier sections than on the later. Hence information is required that connects temperature rise, watts per sq. in. of wire surface and time in circuit.

The best plan is to make an experimental resistance of the type to be manufactured, preferably using a resistance material, such as Constantan, which has a zero temperature co-efficient. The tests consist of a series of readings with different values of the current, in which time, amperes, volts and temperature rise are accurately recorded. The temperature of the resistance material is conveniently taken by a thermometer placed at the hottest point of the resistance which will generally be at the middle of the top bank. The permissible watts per sq. in. of conductor surface which can be dissipated for times intermediate between those given by the typical curves in fig. 1 can be obtained by interpolation, or a new set of curves can be drawn with times measured vertically for different values of the temperature rise.

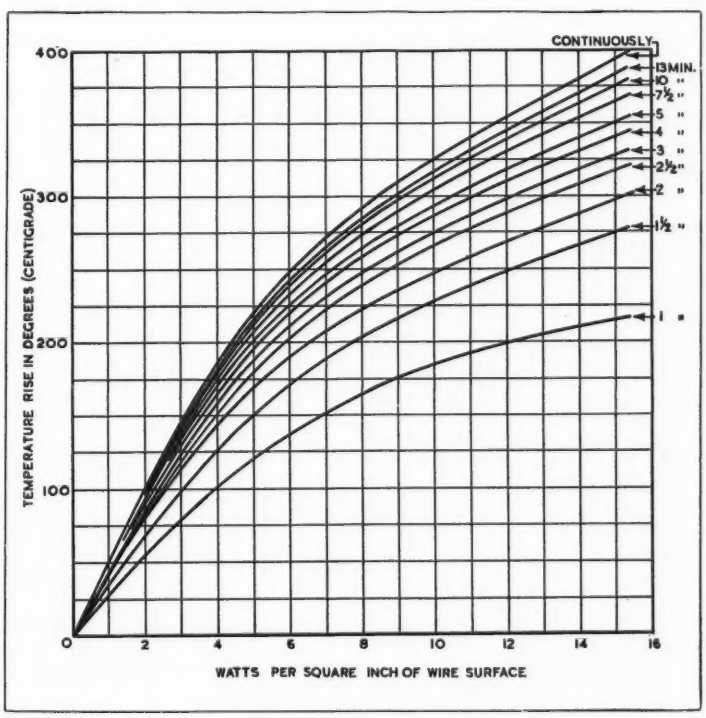


Fig. 1.—Results of tests made upon an experimental resistance

The times for which the different sections of the resistance are in circuit are derived from the specification of the rating. Thus for a five-minute rated resistance, as defined in B.S. Specification No. 587, the resistance is in circuit for two minutes on the first step and for three minutes equally divided between the remaining steps out of each period of fifteen minutes. Thus in a five-step resistance the first section is in circuit for two minutes, the second for three minutes, the third for four minutes and the fourth and last section for five minutes. Besides the standard ratings given in the Specification, 7½-, 10-, and 15-minute ratings are in common use, which are the same as the standard five-minute ratings except that the times in circuit are increased 50, 100 and 200 per cent.

To arrive at the correct grading of ohmic values it is necessary to have particulars of the motors with which the resistances are used. For DC series motors, which comprise the bulk of those used on cranes, the information is generally available in the form of curves showing the relationship between the current, torque and speed. The curves shown in fig. 2 give the average characteristics of series motors as used on cranes. Other information required for calculating the grading and for calculations in connection with some of the more complicated systems of control for series motors is given by an open circuit curve at normal full-load speed. A basis most convenient in estimating ohmic values is to express these in terms of the ohmic resistance which is required to be in circuit, including that of the motor

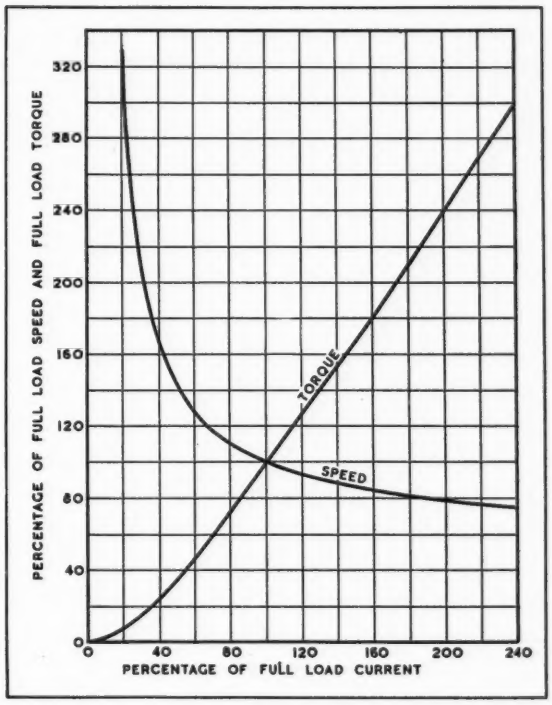


Fig. 2.—Average characteristics of series motors as used on cranes

itself, in order to pass full-load current with the armature at rest. Thus if R is this basic resistance, it is by Ohm's Law equal to the supply volts divided by the rated full-load amperes of the motor.

Particulars relating to a considerable number of series motors which have come into my possession in the course of business show that the average value of the resistance of series

TABLE I.

(1) Per cent. full load current.	(2) Per cent. full load speed.	(3) Voltage drop (per cent.).	(4) Back EMF (per cent.).	(5) Voltage at full load speed (per cent.).
220	75.5	19.8	80.2	106.2
200	78.5	18.0	82.0	104.5
180	81.5	16.2	83.8	102.8
160	84.5	14.4	85.6	101.3
140	88.5	12.6	87.4	98.8
120	93.5	10.8	89.2	95.5
100	100.0	9.0	91.0	91.0
80	110.0	7.2	92.8	84.3
70	117.0	6.3	93.7	80.1
60	127.0	5.4	94.6	74.5
50	143.0	4.5	95.5	66.8
40	168.0	3.6	96.4	57.4
30	216.0	2.7	97.3	45.1
25	262.0	2.25	97.75	37.3
20	330.0	1.8	98.2	29.7

motors as used on cranes is $0.09R$, and this is the figure I use for general design purposes. It is no doubt high for large motors, but, on the other hand, there is generally an appreciable amount of resistance added to that of the motor in the way of trolley wires, cables and contact resistance, and I find that no appreciable error is introduced for the sizes usually met with. For shunt and compound motors with up to 15 per cent. of compounding a figure of $0.05R$ is more appropriate. The open-circuit curve for series motors is easily derived from fig. 2, as shown by Table I.

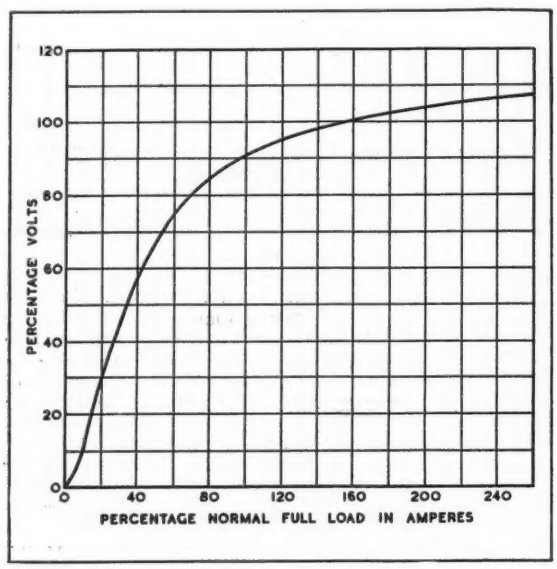


Fig. 3.—Average open circuit curve based on a motor resistance of 9 per cent. of $\frac{V}{I_s}$

The figures in columns (1) and (2) of Table I are taken direct from the curves of fig. 2. In column (3) the figure of 9.0 opposite the figures of 100 in columns (1) and (2) arises from the assumption that the motor resistance is 9 per cent. of R. The other figures in (3) are the product of 9.0 and the appropriate factor taken from (1); thus at 200 per cent. of full-load current the voltage drop is 9.0 multiplied by 2. The figures in column (4) are the difference between those in column (3) and 100.

Column (5) of the table is obtained by dividing the figures in column (4) by the appropriate factor taken from column (2); *e.g.*, 106.2 is 80.2 divided by 0.755. The figures in column (5) plotted with those in column (1) give the open circuit curve (fig. 3), which is plotted with the values of the current and volts shown as percentages. Alternatively the curve may be regarded as relating to a 100-V motor whose full-load current is 100-A.

In a starting resistance which is cut out step by step the current rises to a peak value every time a section is cut out by the controller. The usual practice is to grade the ohmic values of the various sections so that, with a resistance designed to pass full-load current on the first step when the motor starts against full-load torque, all the peak values of the current on successive starting steps are the same. As the motor speeds up, the current on each successive step falls from the peak value to the rated full-load current of the motor, and it is assumed that the controller is moved from one step to the next at the moment full-load current is reached. The heating caused by the flow of the current, or the watts dissipated, in a resistance is proportional to the square of the current.

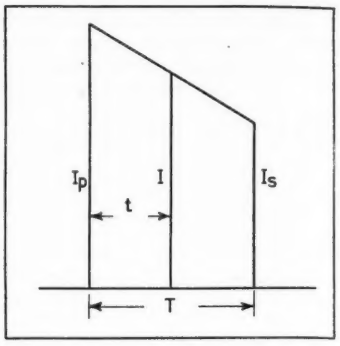


Fig. 4

For those sections of the resistance that carry a variable current, the RMS value of the current must be calculated in order to arrive at the watts dissipated in each section. If the current values during the fall from the peak to full load values are plotted against time as the base, it will be found that the curve has a logarithmic or hyperbolic shape. To simplify the calculation, without introducing serious error, it is assumed that the fall of the current follows a straight line law (fig. 4). The straight line joining the peak and full load values lies above the part of the true curve under consideration, giving too high a figure for the mean value of the square of the current. The error which is introduced is thus on the safe side.

Let I_p be the peak value of the current, I_s the steady value (=rated F.L. current), T the time taken for current to fall from I_p to I_s, then referring to fig. 4, if I is the current at time t, $I=I_p-(I_p-I_s)\frac{t}{T}$ and $I^2=I^2{}_p-2I_p\left(\frac{I_p-I_s}{T}\right)t+\left(\frac{I_p-I_s}{T}\right)t^2$.

Referring to fig. 5, where the area of element is I^2dt, the total area under curve is $I_s^2\int_0^T dt-2I_p\left(\frac{I_p-I_s}{T}\right)\int_0^T t\,dt+\left(\frac{I_p-I_s}{T}\right)^2\int_0^T t^2dt$

$$\text{or } I_p^2T+I_pI_sT+\frac{I_s^2T}{3}$$

Dividing by T, the mean value of $I^2=\frac{I_p^2+I_pI_s+I_s^2}{3}$, so that the assumption of a straight line law for the fall of the current gives simple expressions for calculating the mean value of the square and the RMS value of a variable current.

It is now required to determine the grading of the resistance, *i.e.*, to find the ohmic values of the various sections so that when the controller is moved from step to step the peak values of the current on successive steps shall be the same. To illustrate the method, take the case of a series motor starting against full-load torque with a resistance to pass full-load current on the first step. As the field coils are traversed by the armature current the flux of the motor does not remain constant during starting but increases from normal full-load flux to some value depending on the peak value of the current every time the controller is moved from one step to the succeeding step. To simplify the calculation, assume that the resistance is for use with a 100-V motor whose rated full load current is 100 A.

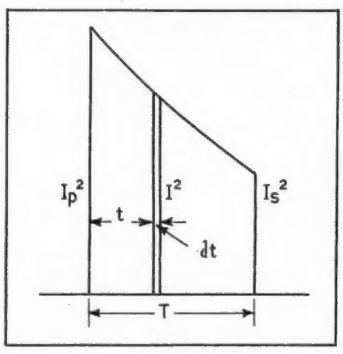


Fig. 5

Referring to fig. 6, the problem is to determine the values or r_t, r_1, r_2, r_3, - - - - - r_m, from which the ohmic values of the various sections, viz., R1—R2, R2—R3, etc., may be determined.

As the motor is starting against full-load torque and the resistance is designed to pass full-load current on the first step, the motor will not start until the controller has been moved to the second step, when the current increases from

the steady value of I_s to the peak value I_p, the ratio of the first to the second being represented below by K. Therefore, $r_1 = \frac{V}{I_p}$, if V represents the line EMF.

When the motor gathers speed and the current falls to I_s, the voltage across the motor on the second step, or the back

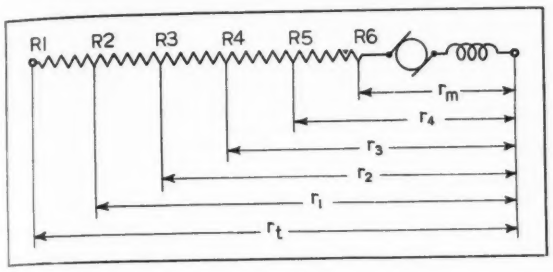


Fig. 6

EMF, is equal to $V - I_s r_1 = E_1$. On moving the controller from the second step to the third step at constant speed E_1 changes to E_2, due to the flux changing from Φ_1 (its value when I_s is flowing in the field coils) to Φ_2 (when I_p is flowing in the field coils). Therefore $\frac{E_2}{E_1} = \frac{\Phi_2}{\Phi_1} = K_1$ and $E_2 = V - I_p r_2$, whence $\frac{E_2}{E_1} = \frac{V - I_p r_2}{V - I_s r_1} = K_1$, $V - I_p r_2 = K_1(V - I_s r_1)$, $\frac{V}{I_p} - r_2 = K_1\left(\frac{V}{I_p} - \frac{I_s}{I_p} r_1\right)$, $r_1 - r_2 = K_1(r_1 - K r_1)$ and $r_2 = r_1 - K_1(r_1 - K r_1) = K K_1 r_1 - (K_1 - 1) r_1$.

Similarly on moving the controller from the third step to the fourth step we find that $r_3 = K K_1 r_2 - (K_1 - 1) r_1$, and on moving the controller from the penultimate step to the last step we find that $r_m = K K_1 r_{m-1} - (K_1 - 1) r_1$. We thus arrive at a series of equations for determining the values of r_t, r_1, r_2, - - - - r_m. To show the method of determining these values we will take the concrete case of a five-step controller, in which $V = 100$ volts, $I_s = 100$ amperes, and $r_t = \frac{V}{I_s} = \frac{100}{100} = 1.000$ ohm, $r_1 = \frac{V}{I_p}$, $r_2 = K K_1 r_1 - (K_1 - 1) r_1$ $r_3 = K K_1 r_2 - (K_1 - 1) r_1$ and $r_m = 0.09$, since assumed value of motor resistance $= 0.09\,R$.

To solve the above equations we have recourse to a method of trial and error. What we have to do is to choose a value for I_p so that after the equations are solved in turn r_m has the value of 0.09 ohm. Assuming that $I_p = 154.5$ A, then $K = \frac{100}{154.5} = 0.648$. Referring to the open circuit curve of fig. 3 we find that E_2, with an exciting current of 154.5 amperes, is 100.2 V and that E_1, with an exciting current of 100 A, is 91 V.

$K_1 = \frac{100.2}{91} = 1.102$, $K K_1 = 0.648 \times 1.102 = 0.715$, $K_1 - 1 = 0.102$, $r_1 = \frac{V}{I_p} = \frac{100}{154.5} = 0.648$ ohm, $r_2 = (0715 \times 0.648 - (0.102 \times 0.648) = 0.397$ ohm, $r_3 = (0.715 \times 0.397) - (0.102 \times 0.648) = 0.218$ ohm. $r_m = (0.715 \times 0.218) - (0.102 \times 0.648) = 0.090$ ohm.

Having obtained the values of r_t, r_1, r_2, r_3 and r_m, we obtain the ohmic values of the various sections of the resistance, thus :—

Res. of R1—R2 $= r_t - r_1 = 1.000 - 0.648 = 0.352$ ohm.
,, ,, R2—R3 $= r_1 - r_2 = 0.648 - 0.397 = 0.251$ ohm.
,, ,, R3—R4 $= r_2 - r_3 = 0.397 - 0.218 = 0.179$ ohm.
,, ,, R4—R5 $= r_3 - r_m = 0.218 - 0.090 = 0.128$ ohm.
,, ,, Motor $= r_m$ $= 0.090$ ohm.
Total $= 1.000$ ohm.

To apply these results to obtain the ohmic values of the various sections of resistances for use with any motor, all we have to do is to calculate the value of $R = \frac{V}{I_s}$ and multiply R by the appropriate factor; thus the ohmic resistance of the first section R1—R2 is R × 0.352, of the second, R2—R3, R × 0.251, and so on. The grading of resistances with numbers of steps other than five is worked out by the same method.

The next step is to determine the RMS value of the current in each section of the resistance. To illustrate the method we will take the same resistance for which we deduced the ohmic values and assume a five-minute rating in accordance with B.S. Specification.

Section R1—R2.—As the motor does not start on the first step, the current flowing in this section remains constant all the time this section is in circuit and has the value of 100 A. This section is in circuit for two minutes (*i.e.*, $t = 2$ min.). Calling the RMS value of the current I, we have : $I = I_s = 100$ A and $I^2 t = 100^2 \times 2 = 20{,}000$.

Section R2—R3.—The second section carries 100 A, the current on the first step, for two minutes and also a variable current, varying from $I_p = 154.5$ A to $I_s = 100$ A, for one minute. Using the formula deduced above for calculating the RMS value of the current, we have :

$$I^2 t \text{ on 2nd step} = \frac{(154.5)^2 + (154.5 \times 100) + (100)^2}{3} \times 1$$

$= 16{,}450$ and $I^2 t$ on 1st step $= 20{,}000$. Total $I^2 t$ of second section $= 36{,}450$. Total time in circuit $= 3$ min. Therefore $I^2 = \frac{36{,}450}{3} = 12{,}150$ and $I = \sqrt{12{,}150} = 110.2$ A.

Section R3—R4.—The third section carries 100 A, the current on the first step, for two minutes, 128.3 A ($= \sqrt{16{,}450}$), RMS value of the variable current on the second step, for one minute and 128.3 A, RMS value of the variable current on the third step, for one minute, since the values of the peak current and the steady current are the same on all starting steps. Then $I^2 t$ or third step $= 16{,}450$, $I^2 t$ on 1st and 2nd steps $= 36{,}450$. Total $I^2 t$ of 3rd section $= 52{,}900$. Total time in circuit $= 4$ min. Therefore $I^2 = \frac{52{,}900}{4} = 13{,}225$. Therefore $I = \sqrt{13{,}225} = 115.0$A.

Section R4—R5.—Similarly : $I^2 t$ on fourth step $= 16{,}450$, $I^2 t$ on 1st, 2nd and 3rd steps $= 52{,}900$. Total $I^2 t$ of fourth section $= 69{,}350$. Total time in circuit $= 5$ min. Therefore $I^2 = \frac{69{,}350}{5} = 13{,}870$ and $I = \sqrt{13{,}870} = 117.9$ A.

The values have been calculated for a motor having a full load current of 100 A, but to obtain the RMS values of the current for any HP of motor it is merely necessary to multiply the full-load current, I_s, by the appropriate factor as indicated in the fifth column of Table II.

TABLE II—5-STEP RESISTANCES FOR DC SERIES MOTORS. 100 PER CENT. INITIAL AMPERES.

Step.	Total resistance in circuit.	Section of resistance.	Ohmic value.	RMS value of current.	Time in circuit (minutes). 5 min. rated.	7½ min. rated.	10 min. rated.	15 min. rated.
1	R × 1.000	R1—R2	R × 0.352	I_s × 1.000	2.0	3.0	4.0	6.0
2	R × 0.648	R2—R3	R × 0.251	I_s × 1.102	3.0	4.5	6.0	9.0
3	R × 0.397	R3—R4	R × 0.179	I_s × 1.150	4.0	6.0	8.0	12.0
4	R × 0.218	R4—R5	R × 0.128	I_s × 1.179	5.0	7.5	10.0	15.0

$R = \frac{V}{I_s}$ where V = line volts and I_s = full load current.

Peak current $I_p = I_s \times 1.545$. Motor resistance = R × 0 090.

Now in a five-minute rated resistance the resistance is in circuit for two minutes, *i.e.*, 40 per cent. of the starting time, on the first step and for a further three minutes, *i.e.*, 60 per cent. of the starting time, equally divided between the remaining steps. In the case of 7½-, 10- and 15-minute-rated resistances, the starting time is divided between the various sections in the same proportion as obtains in the case of the five-minute rated resistance and therefore the RMS values of the currents in the various sections ase deduced above are the same for all these ratings.

Table II, together with information given by curves similar to those of fig. 1, gives in a convenient form all the data necessary for designing resistances to pass 100 per cent. of full-load current on the first step for use with DC series motors and five-step controllers. Similar tables applicable to resistances for use with controllers having other numbers of steps are produced by the same method. In deducing tables applicable to resistances for use with compound motors a characteristic curve showing the relationship between the armature current and the back EMF at normal full-load speed is used for finding the values of E_1 and E_2 instead of the open-circuit curve of fig. 3 used for series motors.

In deducing tables for resistances for use with shunt motors advantage is taken of the fact that the flux remains constant during starting. In the calculation of the grading of resistances for use with series motors the following series of equations were obtained : $r_t = \frac{V}{I_s}$, $r_1 = \frac{V}{I_p}$, $r_2 = K K_1 r_1 - (K_1 - 1) r_1$, $r_3 = K K_1 r_2 - (K_1 - 1) r_1$, and $r_m = K K_1 r_{m-1} - (K_1 - 1) r_1$.

Since the flux of the motor during starting is constant $\Phi_2 = \Phi_1$, and therefore $K_1 = \frac{\Phi_2}{\Phi_1} = 1$. Substituting for K_1 in the above equations for series motors we obtain the following :

$r_t = \frac{V}{I_s}$, $r_1 = \frac{V}{I_p} = K r_t$, since $\frac{r_1}{r_t} = \frac{I_s}{I_p} = K$, $r_2 = K r_1 = K^2 r_t$, $r_3 = K^2 r_1 = K^3 r_t$ and $r_m = K^{m-1} r_1 = K^m r_t$, whence $K^m = \frac{r_m}{r_t}$ and $K = \sqrt[m]{\frac{r_m}{r_t}}$, where m is one less than the number of steps in the controller.

The above equations show that, for equal peak currents on all the starting steps of resistances for use with shunt motors, the ohmic values of the total resistance in circuit on each step of the controller are in geometrical progression.

New Books

Alternating-current Circuits. By R. M. KERCHNER and G. F. CORCORAN. (Pp. 510; figs. 224.) London: Chapman & Hall, Ltd. Price 23s. 6d.

ALTHOUGH this volume has been primarily written as a textbook for students in electrical engineering colleges, the authors have included a considerable amount of material beyond what is given in the average college course, thereby extending its sphere of usefulness to the practising engineer. With this double object in view, they give in the first ten chapters a careful survey of the various types of circuits met with in AC practice, starting off—after an interesting historical survey—with the simple sine-wave form and considering the effect of resistance, self-inductance, and capacitance either singly or in any likely combination. Then they give an investigation of the sinusoidal single-phase circuit, followed by a chapter on non-sinusoidal waves. Both balanced and unbalanced polyphase circuits are considered, as also are coupled circuits, the first portion of the work also including a chapter on AC measurements in which, among other things, the cathode-ray oscillograph is described.

For the more advanced reader there are chapters dealing with the measurement of polyphase energy, transmission-line calculations, and power-system short-circuit calculations, while the important subject of transient conditions, such as occur during the starting-up of a machine or during any switching operation, is investigated. This part of the work should prove of considerable value, as it is during short transient periods that some of the most serious and involved operating problems are encountered. Throughout the book (which is of American origin) the authors have assumed that the reader has a knowledge of the differential and integral calculus, and they make full use of vector algebra wherever possible. Numerous exercises, fully worked out, are given throughout the text, and further exercises, together with the numerical answers, are given at the end of each chapter.

The publishers of this excellent book evidently believe that it is during his student days that the engineer begins to gather about him a technical library, since on the inside cover is a name-plate with Carlyle's dictum, "the true university is a collection of books."—A. R.

Mechanical Engineering Science. A Second Year Course. By DRS. ARTHUR MORLEY and EDWARD HUGHES. (Pp. 260; figs. 77). London: Longmans, Green & Co. Price 4s. 6d.

This volume follows the recently published "Elementary Engineering Science," prepared by the same authors in order to provide a cheap textbook for students taking the National Certificate courses. It dealt with the fundamentals of mechanics, heat and electricity, and the present book continues the study of mechanics and heat at a stage suitable for students in their second year. Here again the emphasis is laid on energy, but while this has the merit of serving as a link between the two branches and of providing a simple means of approach to many problems, this system of presentation is open to criticism. The student becomes strongly predisposed in favour of the method with which he has been familiarised and correspondingly diffident towards the others. The modern tendency to prefer the easy way is responsible for the weakness of more advanced students when face to face with problems requiring the ready application of several principles.

The subject matter dealt with has been wisely chosen to meet the needs of the electrical engineering student as well as his opposite number on the mechanical side. The special needs of the former require that he should obtain a knowledge of the general principles associated with heat engines, boilers and machinery rather than of the mechanical details of these. In the development of their subject the authors have adopted the following sequence—dynamics, laws of motion, energy, hydraulics, mechanics of gases, principle of the heat engine, engines, boilers, and combustion. The elementary thermodynamics introduced has been presented in simple and direct terms and with the minimum of reliance on mathematical analysis. In places, the phraseology tends to be rather obscure and may cause the student some distress but reference to the very numerous worked examples will resolve most of his immediate difficulties.—J. A. C.

Ferromagnetism. By J. R. ASHWORTH, D.Sc. (Pp. 97.) London: Taylor & Francis, Ltd. 7s. 6d.

The investigations described in this book were initiated when Dr. Ashworth had occasion to examine the problem of improving the magnets used in magnetic observatories so as to make them independent of temperature variations. The first account of his work was published in the *Proceedings* of the Royal Society in 1897. The scope of the investigation was soon extended and, altogether, the author has published twenty-two papers dealing with his researches, the most recent having appeared in the *Philosophical Magazine* last year.

This book gives, in brief, the results of the series of experiments which the author has carried out during this period of forty years and the main theme of the work is a development of Curie's surmise that there might be critical constants for magnetisation phenomena as for fluids. Curie's law of paramagnetic substances states that, under a constant force, the intensity of magnetisation of ferromagnetic substances when in the paramagnetic condition, that is at temperatures above the critical point, is inversely proportional to the absolute temperature. The author has extended this law to include paramagnetic and ferromagnetic substances in the same way as Van der Waal's equation includes the characteristics of gas and fluid. Thus, Curie's law of paramagnetic substances may be treated as a limiting case of a more general equation for magnetism which embraces the two salient facts of ferromagnetic substances, *viz.*, a limit to the magnetic intensity (or density) and the mutual reaction of the elementary magnets on one another.

A very important aspect of magnetic theory is the question of the magnitude of the intrinsic field in ferromagnetic substances. According to Weiss this intrinsic field is of enormous magnitude—of the order of 20×10^6 oersted—acting over limited domains, whereas the author, in the light of the ferromagnetic equation, has made out a striking case for the view that there are two fields in operation, one a relatively small true magnetic field responsible for the magnetic effects, and the other of such a kind as to account for the thermal characteristics of a ferromagnetic substance. Forces such as determine "order" in the atomic structure of crystals are suitable for this second field.

Another phenomenon of ferromagnetic substances is the discontinuity of the specific heat when the temperature is raised to the critical value. A particularly interesting example is provided by the Heusler alloys in which manganese is the active magnetic material. The element manganese is non-magnetic but there is a critical temperature at which there is a sudden discontinuity of specific heat and this is approximately the critical temperature at which the Heusler alloy becomes non-magnetic. Manganese is a most remarkable example of a metal with hidden ferromagnetism a discovery which was also arrived at by Steinmetz for other reasons.

The book is well printed and it is to be hoped that the author will be encouraged to continue his investigations which have already yielded such fruitful results.—T. F. W.

Principles of Electricity and Electromagnetism. By G. P. HARNWELL. (Pp. 619; illus.) London: McGraw Hill Publishing Co., Ltd. Price 30s.

This is one of the "International Series in Physics," a set of publications of American origin and is more a text-book of mathematical physics than a technical book. A technical man would find its descriptions and illustrations inadequate. As a class book it is too advanced, but for what it professes to be it is comprehensive and excellent in every way. Its treatment of the subject shows that the book is intended for post-graduate students or for reference rather than for general teaching.

Starting with electrostatics we go through direct current straight to the theory of alternating currents before the simple voltaic cell is reached. Electrochemical action is followed by conductivity through gases and all that that entails. After that we meet the Ampere law, electromagnetism and induction, and then the facts of magnetism. The book finishes up with a theoretical discussion on radiation and a mathematical appendix. Though perhaps not well adapted for teaching, theoretically this method has many advantages.— W. R. C.-A.

Atomic Structure. By L. B. Loeb. (Pp. 446; figs. 106.) London: Chapman & Hall, Ltd. Price 27s. 6d.

The author of this book is Professor of Physics in the University of California, and the book has been written for advanced students in physics, chemistry, mathematics, and engineering. An historical survey is given of the astonishing and revolutionary period which began in 1895 with Röntgen's discovery of X-rays, and culminated in the evolution of "wave-mechanics" in the period 1925-1927. The treatment proceeds in historical sequence, and the approach is consistently mechanical and classical. At those stages in the development where the classical picture breaks down, the wave-mechanics extension is indicated wherever possible.

The treatment is clear and comprehensive, and, in so far as engineers are concerned, it seems specially suitable as a preparation for work in the field of electronics and discharges in gases. The diamagnetic and paramagnetic properties of atoms are considered in a short chapter, and the fundamental characteristics of ferromagnetism are referred to the spin moments of certain of the electrons and to the mutual interaction of these spinning electrons. Of particular interest is the chapter on the electron theory of metals, as well as the succeeding chapter on the wave mechanical concept of the metallic state. Reference is made, for example, to the elegant Tolman-Stewart experiment which proved directly the existence of free electrons by spinning a metal disc at a high speed so that these electrons were flung towards the periphery by the centrifugal force, thus giving the periphery of the disc a negative potential with respect to the centre. Ohm's Law, contact potential, the thermionic, thermo-electric, and Hall effects are also considered from the standpoint of the free-electron theory, although the author is careful to point out that, whilst everything supports it qualitatively, this theory is faulty in many respects.

For advanced students and research workers who have had the necessary preliminary training, this book can be recommended as a valuable and reliable work of reference.

T. F. W.

Engineers and the State

Help for Students

IN his presidential address to the ENGINEERS' ASSOCIATION in Dublin on December 17th Prof. F. E. Hackett dealt with "The Engineer in a Changing Industrialisation." He suggested that the explanation of the inventive predominance of such countries as Switzerland, Denmark, Sweden and Holland lay in their higher technical institutes, such as those established at Zurich, Copenhagen, Stockholm and Delft. Undoubtedly these had contributed largely to the industrial activities of their respective countries. The Faculties of Science and Engineering in British and Irish Universities were, in many respects, their equivalent. But it could not be said that any definite system had been evolved for the genesis of inventions or the nurture of inventors.

Overseas Training Needed

University graduates in engineering, like young seedlings, required to be transplanted several times, so that they could strike a strong root growth into the soil of experience. In countries with a healthy and natural industrial development adequate opportunities existed for allowing the young engineer to mature by a variety of industrial experience. Ireland must provide the opportunities.

In his presidential address last year Prof. Hackett advocated an endowment of £10,000 to be spent over ten years in assisting at least twenty young Irishmen to seek further training abroad for periods of one or two years. He again repeated his opinion that in national economics no other expenditure, in the long run, was more certain to prove advantageous to the country and to yield a greater proportionate return to the national wealth. The Department of Industry and Commerce, under the Ministries Act, had powers to make educational grants to enable young engineers to gain works experience abroad.

The nineteenth century riot of individualism was in constant antagonism with the forces of standardisation and unification, derived from the progress of discovery. But co-ordination was inevitable, based on some form of central control, if the community was to obtain the full benefit of technical advances. For instance, telephones following on telegraphy had dragged the State into administering a great scientific service of communication. Radio broadcasting had led the Post Office also to supply an entertainment and education service. The Electricity Supply Board was another example of the thesis that the process of planning by the State would continue.

They dared not stop their effort to assimilate new methods and new industries. The future status of the engineering profession would depend on comprehension of this process and whether one learned to view it from above or below.

In future developments in the social structure the professional engineer should also be able to exert his influence. Engineering activity was the originating cause of these developments: merely the application of science under the restriction of finance. The engineer was already one-fourth an accountant. His training and mental technique operated with figures and costs much in the manner of an accountant. There was no difficulty in the engineer extending his range so as to grasp and understand the discussions which all planning systems involved. Prof. Hackett said he felt very strongly that the future status of the profession would largely depend on the extent to which it could "throw up" men who could enter into such discussions on the fundamental questions concerned with the industrial organisation of the State.

Planning Industrial Development

The responsibility for the planning of Irish industrial development rested with the Department of Industry and Commerce. Hitherto the "economic war" required it to pursue mainly a short-term policy. The period of easy, rapid development was now over and, with the economic dispute with Britain out of the way, it was possible to plan on a long-term basis. The receptivity of industry to scientific ideas twenty years hence would depend on the managers and directors of that day. They were now entering industry as recruits. It was of great importance that these new recruits who were going to be the executives of the future should be trained in science or engineering. Every endeavour should therefore be made to induce all important industries associated in any way with engineering to make positions for graduate engineers.

There was a grievous lack of foresight in estimating potential demand on scientifically or technically trained personnel on the part of Government departments. The smallness of Ireland necessarily limited the demand for specialist engineers and technicians, and unless they changed their methods, Government departments and industrial firms would continue to explain that they had to engage foreign technicians.

Here and There

By Nomad

I HAVE recently sensed a very deep concern among responsible engineers about defective wiring and have heard references to two main sources of the trouble. Mr. Duckworth, of the Croydon undertaking, who showed me some alarming specimens of faulty work, spoke of schoolboys who, because of the knowledge of electrical theory they acquire nowadays at school are entrusted by proud parents with any extension of the house wiring. Mr. Willis, of the Sun Electrical Co., Ltd., told me of a growing class of "week-end wiremen" who purchase over the trade counter weekly just sufficient materials to wire a house.

* * *

It is not suggested that every "week-end wireman" nor every "handy schoolboy" is responsible for bad workmanship. But defective wiring is being increasingly installed and the problem needs urgent attention. The schoolboy issue should be easy to tackle. "Educate the public!" is one of the principal tenets of the electrical industry and in this case it should be simple to get the support of the educational authorities.

* * *

The bogus wireman problem, however, is much more difficult to solve, because of the strong and opposing feelings that exist on the much-discussed and long-standing questions of *yet more* legislation, registration, and so on. Often, too, the mind which is convinced of a remedy finds principles allied thereto repellent. For instance, Mr. Reed, of Samuel Reed & Sons (registered electrical contractors), who favours registration of operatives as well as of employers, suggested to me that

[*Elec. Rev.* photo.

Defective wiring in Croydon houses: Left, Joints in l.c. cable with loosely twisted and insulated conductors and "bonding" wires held by tape. Right, Metal rim of fishpaste jar fixed to ends of element in fuse box by tape to restore supply

before a man receives his full rate of pay he should have a certificate of competency from some authority. On the other hand, he cannot see why any man who can do his work properly should be prevented from doing so because he is not, say, registered, certificated or licensed. To my mind the interests of the public should be the deciding factor.

* * *

I agree with Mr. Walter Riggs, president of the Electrical Contractors' Association, who, with reference to the I.E.E. Regulations, said it is much better to have limited supply with safety than unlimited supply without safety. I think that a little less of the letter and a little more of the spirit of regulations might prevail in the interests of safety.

* * *

I know of instances where consumers have received a "schedule of defects" relating to such things as the use of two-pin plugs and of non-t.r.s. "drops," and of one case where the wiring department of the undertaking, when carrying out work which included remedying such defects, fixed a lamp so that the glass was within two inches of a matchboard ceiling and rewired a fire without replacing the internal heat-insulating beads. Such things represent an abuse of regulations by those whose main object should be to secure safety.

The problem presents two great difficulties. Electrical installation work is largely hidden and many examples of bad workmanship are not indicated by normal installation tests. Therefore nothing short of detailed inspection of work can ensure absolute safety. But who can and will undertake to provide such detailed inspection? The only authority who can prevent the *use* of defective wiring is the supply undertaking.

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

AC Leakage Effects

IN your leader of December 16th dealing with the use of water pipes for earthing it is stated—"electrolysis can be caused by the voltaic-cell effect produced by two dissimilar metals in acid or alkaline surroundings—and with this earthing has nothing to do." In the same issue you give particulars of an experiment described by Mr. H. W. Swann, Senior Electrical Inspector of Factories, which proves that an AC leakage current can have a DC component which produces, for example, electrolytic deposition of copper. The above refers to water pipes, but the effect is of greater importance when earthing is by means of driven electrodes.

The fact that partial rectification of AC occurs under some initial conditions leads to a further degree of rectification as the electrodes are corroded by the DC component. If, for example, an electrode is driven three feet into earth which is usually more conductive near the surface while the soil is wet, then a persisting leakage current would produce a lower potential between electrode and surrounding earth than it would when the upper soil becomes dry and less conductive. The conditions will vary with wet and dry seasons, and so also will the degree of rectification, which is governed by the potential at the film of corroded metal. That is, at a low voltage the maximum rectification would occur, but at a slightly higher voltage there would be a breakdown of the film when practically the full AC would flow.

Such potentials might reach very high values if, in a dry season, only the lower end of an earth electrode were in contact with moist earth and the electrode surface had been seriously corroded by the persisting DC component when the electrode remained at low voltage. The conductivity of the soil is not primarily due to its moisture but to the impurities which make the moisture conductive; such impurities are retained near the surface and filtered out as water seeps. The action of a rectified AC is to disperse the impurities, especially when they are in slight concentration. Again, the impurities themselves may be influenced by the potential in a similar manner to the ionisation of gases in the glow discharge.

To revert to your leader and voltaic action: it is possible for a small AC leakage current to produce alkalinity in the soil surrounding a water pipe or earth electrode and thereafter the voltaic-cell effect would follow. I described an experiment in your "Correspondence" section of September 16th last, in which a high degree of alkalinity was produced in water when a rectified AC was conducted by the water; this experiment also indicated the dispersal of the impurities in the water and accounted for its variable conductivity. The alkalinity at the cathode can produce other effects by chemical action with soil in contact with the electrodes, so once the action commences it can continue until the effect is to isolate the electrodes and the apparatus depending on them. A. G. BULLEN.

Liverpool, 8, *December 16th*.

Tendering Conditions

I have recently had to draw the attention of prominent firms to their neglect of conditions quoted in advertisements. Under the authority of my Council I recently advertised for transformers. The advertisement clearly and distinctly stated that tenders were to be submitted in a perfectly plain envelope, and marked "Tender for Transformers," and in the terms and conditions the same requirement was plainly stated.

Certain firms did not mark their envelopes as requested; consequently they were opened, not by the committee appointed, but by myself, and I have had no alternative but to disqualify those tenders. Municipal government is often criticised, but when an attempt is made to eliminate doubt and criticism, and to preserve the integrity of chief officials, instances such as these arise. They would never occur if the firms tendering made some person responsible for seeing that the terms of an advertisement were complied with.

This difficulty has arisen previously with other authorities, and a reference to the technical Press will show that a town clerk to one local authority complained of the procedure adopted, and the neglect apparent by firms tendering. I trust that this letter will result in improvement, in order to save the necessity of an official relegating hours of work to the waste paper basket. Surely it is not asking too much of the manufacturers to give attention to small but vital and important details. O. G. COOK,

Electricity Department, Chief Engineer and Manager.
Bingley, *December 22nd*.

Safety in Mines

Royal Commission's Report

THE Royal Commission on Safety in Coal Mines, whose Report running to 520 pages was issued just before Christmas (Stationery Office, 7s. 6d. net), was set up three years ago under the chairmanship of Lord Rockley. The Chief Inspector of Mines, Sir Henry Walker, was a member of the Commission and the following were among the witnesses examined with regard to electrical matters: Mr. A. R. Chaytor (Mine-workers Federation of Great Britain), Major E. I. David (president Assoc. Min. Elec. Engrs.), Mr. J. A. B. Horsley (Elecl. Inspector of Mines) and Professor R. V. Wheeler (Director, Mines Research Stations).

Mining, the Report states, is the most dangerous of the major industries and the co-operation of the workers is necessary to secure a high standard of safety. One of the first recommendations is that there should be a Central Research Board, but of a consultative and advisory character instead of mainly administrative as at present, co-ordinating all research on safety and health.

Electricians and their assistants appointed by the manager under the Electricity Regulations should have statutory qualifications in two grades, Grade I to apply to electricians-in-charge in mines where the voltage is over 650, the plant installed exceeds 250 kW and no flameproof apparatus is used. Electricians should be statutorily responsible for maintenance, the manager specifying how the duties are to be carried out including the frequency of examinations or tests. Electricians employed in less responsible grades and apprentices should hold "service certificates" of competency. It would often be advantageous for both electrical and mechanical plant to be under the charge of one official. Electrical apparatus within 300 yd. of the face and portable apparatus in use in this zone should be examined by a competent electrician at least once in twenty-four hours. Electricity should not be introduced or continued in use within 300 yd. of the coal face when the average firedamp exceeds 1 per cent. and should be cut off from any apparatus in the neighbourhood of which any gas-cap can be seen on the flame of a safety lamp.

Motors driving loaders and conveyors should be examined by a competent person when erected in new positions before current is switched on. Efficient lighting at prescribed standards should be provided at busy points. Except in roads ventilated by intake air and not within 300 yd. of the face, the installation of further electrical apparatus in any ventilating district on the return side of the point up to which approval has already been given should be notified to the district inspector. The use of approved flameproof apparatus should be compulsory in safety-lamp seams within 300 yd. of a working face or elsewhere when the representative gas content exceeds 0.5 per cent., subject to the retention for three years of non-approved apparatus which complies with General Regulation 132 (1).

As a safeguard against fire, the provision of automatic leakage protection should be considered by the proposed committee on the revision of the Electricity Regulations. Fixed switchgear and motors should not be installed within a prescribed distance of inflammable material.

New Belfast Station

OUR Belfast Correspondent reports that the future development of the Corporation's electricity undertaking is at present engaging the attention of the Electricity Committee, which contemplates the erection of an additional power station at an early date. Sites are at present being considered, and it is understood that possibilities of the old North Yard of Workman & Clark, a former leading ship-building firm, are being investigated. The matter has as yet been only tentatively considered by a sub-committee of the Electricity Committee and officials of the Corporation, but proceedings have gone as far as the opening of preliminary discussions with the Belfast Harbour Board. The growth of the demand was indicated at a meeting of the Electricity Committee when Mr. F. H. Whysall (city electrical engineer and general manager) reported that in the period from April 1st to December 13th there had been an increase of 7,133,035 kWh over the corresponding period of 1937, and that within the past fortnight 658 new connections had been made. The Committee is also considering the enlargement of the administrative headquarters in East Bridge Street. The Estates Superintendent has been instructed to negotiate for the acquisition of a portion of the Great Northern Railway's property in Laganbank Road. The Committee has in mind the erection of a power station on the County Antrim side, one of the objects being to obviate the necessity of laying a submarine cable across the River Lagan, as was required recently to provide the increased supply for the north side of the city, which is rapidly being developed. There are other sites in view as well as the North Yard, and the sub-committee will shortly receive a report from the city electrical engineer on the comparative costs.

New Electrical Products

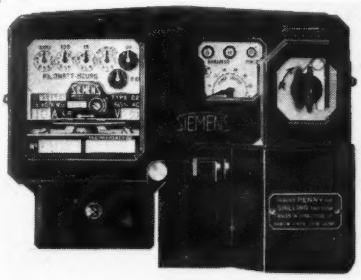
A review of equipment recently marketed

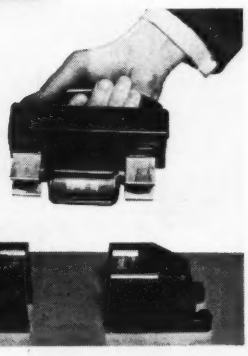
Single-phase Prepayment Meter

THE kWh element of the new prepayment meter (Type 22) of SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4, is similar to that of the Type 21 meter which was described in our issue of September 2nd. The prepayment mechanism can be arranged for single- or dual-coin operation, using shillings and/or pennies and for price ranges of from ½d. to 4d. per kWh by ½d. steps or from ½d. to 8d. by ½d. steps.

The simply-constructed price-range units are self-meshing and may readily be changed *in situ* without the use of special tools. Quick zero-setting devices are provided on the meter and cash-inserted register which is arranged to read up to a total of 99/11. The credit dial registers up to 42 pence.

The case is of an attractive moulding similar to the type 21 in appearance and is suspended to the meter board at two points only. All external metal parts, including the coin receiver and cash box, are carefully insulated from the internal metal parts. A diagram of connections is to be found on the underside of the terminal cover.





Above: The new Siemens prepayment meter. Right: The Ferguson-Pailin high-rupturing-capacity fuse

High-rupturing Capacity Fuses

A range of ceramic-barrel fuses with a short-circuit rating of 25,000 kVA on a three-phase 400-V system has been developed by FERGUSON, PAILIN, LTD., Higher Openshaw, Manchester.

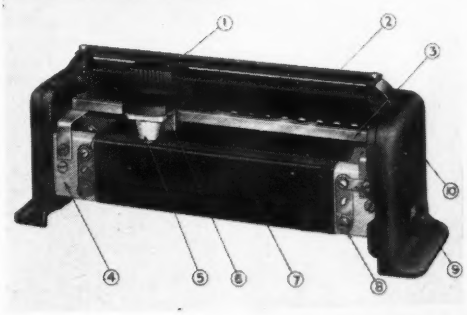
The fusible element is pure silver and is attached to the spun brass end caps of the cartridge by a method that is specially devised to give the most favourable fusing factor. For each current rating two types are available, with different fusing-time characteristics; this enables discrimination to be obtained on overload operation up to several times full-load value.

The cartridge is contained inside a moulded casing and a loose handle is employed for removing the fuse. A neon indicator, which lights up when the fuse blows, can be supplied for plugging into the back of the carrier.

An Improved Slider Regulating Resistance

In our issue of September 30th last we described a new slider regulating resistance introduced by A.E.W., LTD., Imperial Works, High Street, Edgware, Middlesex. Several improvements have now been made, including the provision of flexible copper pigtail connections to the collector brushes and an alteration to the terminal plates so that connection can be made without removing the cover plates. Spring pressure balls are now fitted to give good contact from the slider bar.

Special points about this resistance are the bakelite thumb grip (1), protector bar fitted with an indicator scale (2), and a heavy slider bar (3). The refractory former (4) is ventilated and the plunger contacts (5), which are supported on a roller bearing slider (6) have a large area. The windings (7) are of oxidised nickel copper or nichrome alloy and space wound. The substantial terminals (8) are protected and the cable entry bush (9) can be removed for conduit. The end plates (10) have no sharp corners.



The A.E.W. slider resistance

An Adjustable Lamp

From PETERBOROUGH EXTENSIBLE LAMPS, 100, Princes Street, Peterborough, we have received details of a new lamp standard with three joints, each of which is capable of continuous rotation. No continuity of wire passes from the base to the lampholder, so that each of the parts may be dismantled and reassembled without affecting in any way the utility of the lamp. The base is designed in such a way that the lamp can be fixed in any position, either on the bench or desk, wall, ceiling or side of a machine. All parts are interchangeable and replacements can be obtained if one joint shows more wear than another. The unit is earthed and is subjected to a 1,000-V test for leakage.

The "Pel" extensible lamp

The pedestal type utilises the same principle and the same arms and swivel members, but in this case the lower double swivel is fixed to the upper part of a steel column which contains the switch and through which the wires pass to a junction box at the lower end, the latter being fixed into a three-legged base on ball-bearing castors. Extra arms can be added.

Cathode Ray Monitor Tube

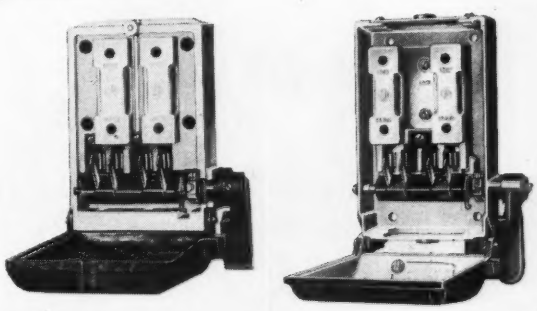
An improved miniature cathode-ray tube for monitoring or other purposes is announced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.

This 1.5-in. tube, Type 4053, operates with the same anode, focusing and modulating voltages as the original 4051, and has identical external dimensions. The sensitivity is, however, improved to 120/V mm. per volt, where "V" is the voltage on the final anode. Also, considerable improvements in the screen have resulted in a finer focused trace and greater freedom from burning. The tube is of the high vacuum type with a green screen and is fitted with a standard British 9-pin base, so that connections are available to each of the four deflector plates separately.

Combined Switch-fuses

BILL SWITCHGEAR, LTD., Aston Lane, Perry Barr, Birmingham, 20, have sent us particulars of two new combined switch-fuses.

The new iron-clad "Ultra 30" and all-insulated "Insulok" combined switch-fuses are of basically similar design. The switch is of the q.m.b. type, the moving blades being fitted to a solid bakelite bar. The base is vitreous china, and the cable blocks are arranged so that they cannot turn when the screws are tightened; the live terminals are completely covered. Arc damping fuses with an easy clamping arrangement for the fuse-wire are fitted and in the case of the "Insulok" model the china base is recessed at the back allowing the cable to be split before connecting. A special "Stoke" cable shield can be supplied to cover the external split cable.



The "Insulok" all-insulated and the "Ultra" iron-clad 30-A switch-fuses

Both these switch-fuses are made to conform with Home Office and I.E.E. Regulations.

D

A Steel Conduit Knuckle Joint

W. J. & H. GARRATT, Premier Works, Wolverhampton Road, Bloxwich, Walsall, have sent us details of a new steel conduit knuckle joint which is suitable for use in the lighting of lathes, machines, presses and benches, &c. It is easily fixed and adjusted in any position by a turn of the fly nut, while the swivel action allows unrestricted adjustment, either vertical or horizontal. All wiring is enclosed, and the joint is designed to prevent undue twisting of the wiring system. It can be held rigid and will withstand any vibration from machinery when fixed in position. It has complete angular movement, being free to pivot to any degree.

Car Sump Heater

JAMES NEALE & SONS, LTD., Graham Street, Birmingham, 1, have just placed on the market an electric sump and general-purpose heater. It is circular, the diameter being 10 in. and the overall height 5 in. A handle is provided and the heater is designed to be placed under the sump of the car instead of being attached to the water-cooling system. The loading is about 140 W.

The "Raydyot" sump heater

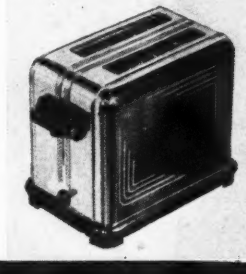
A Ceiling Switch

A bakelite ceiling switch designed by THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, consists of a one-way, single-pole, ratchet-type, quick-make quick-break switch operated by a single cord. The switch mechanism is mounted into a moulded bakelite body which is fitted into a backplate 2¼ in. in diameter with two fixing holes at 2 in. centres similar to, but slightly deeper than, that used on the S752 ceiling rose, which it matches.

This switch movement, which can only be made for one-way switching, has a smooth action and is easily operated by a cord. Back wiring terminals of special design are readily accessible in the recess of the backplate, thereby obviating any dismantling of the accessory.

The new switch is obtainable in either brown or cream bakelite.

The G.E.C. ceiling switch



The Mannin-Bowman automatic two-piece toaster

Domestic Appliances

The range of Manning-Bowman domestic electrical appliances, which include coffee percolators, coffee mills, toasters, waffle irons, hair-dryers, "Rolamatic" heat controlled irons, and portable, whirling clothes dryers, is now being distributed in this country by UNDERWOOD (ELECTRIC), LTD., 7, Park Lane, London, W.1.

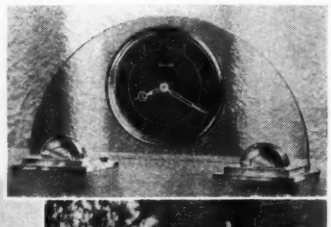
One particularly interesting item just brought out is the low-priced "No. 110" automatic two-piece toaster. Loaded at 725 W, it can be set to give any desired degree of toasting, the current being switched off automatically and the two pieces of toast ejected at the top when cooked. The apparatus measures 8¼ in. long by 5¼ in. wide by 7 in. high and is finished in heavy chromium plating, with moulded walnut base and switch. A three-core asbestos lined flex is provided.

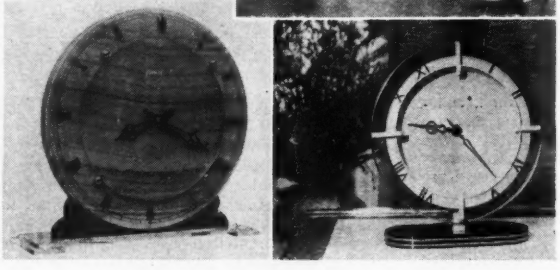
The company is also the sole distributor for Russ soda fountains, rapid freezers, carbonators and frosted food cabinets, and also the Cunningham dish washer. In addition, it is the sole distributor for Apex-Vactric, Ltd., in the North and Midlands and acts as wholesaler for all other makes of domestic electrical appliances.

The Premier "Pylon" kettle

New Clocks

SMITH'S ENGLISH CLOCKS, LTD., Cricklewood, London, N.W., are introducing several new domestic electric clocks. The "Meto-clock," a combined clock, barometer and thermometer, is in an oak case with chromed bezel and fittings. The "Cambridge," a casein clock in blue and chromium or cream and gilt, and the "Goodwood," in veneered walnut or Japanese oak, are newcomers, as are also the "Manton" and "Mardale"





Three new clocks: Top, Ferranti No. 241. Left and right, Ferranti No. 245 and Smith's "St. Ermin"

mantel clocks and the "St. Ermin" (illus.). A much wider field is opened by the introduction of the low-priced "Sovereign," to compete with the cheapest mantel clocks on the market, including those of foreign manufacture. It has a moulded case with chromed bezel, self-coloured dial and cream coloured raised fret zone and hands.

Eleven new models have been put on the market by FERRANTI, LTD., Hollinwood. Two, Nos. 240 and 241 (illus.), with coloured glass surround, are new additions to the range of glass and chromium clocks, and another attractive clock is model No. 245 (illus.) with an onyx dial. The roman figures are printed on plate-glass and the hands are covered by a second convex glass.

The wooden case models represent an advance in design, as shallow depth cases are introduced for narrow mantelpieces. There are two round and two square models.

An unusual model is No. 243 with an octagonal fretted copper or chromium zone and a green anodised or cream dial. The hands are also of copper.

An Automatic Safety Kettle

Bi-metal strip for thermostatic control is employed for the automatic cut-out of a new kettle which PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, 9, have just produced.

This kettle, known as the "Pylon," does not need resetting. Heating is by an immersion element of unusually large area with a low loading per sq. in. to avoid furring; the tubing is of extra heavy gauge.

The operation is simple. The essential part consists of a bi-metal strip securely fixed at one end to the element housing, the other end being free to move away from the face against which it is mounted. In moving, the bi-metal strikes the glass insulated head of a set pin which is attached to a flexible contact arm to which is riveted one of the contacts, this contact being moved away from a similar contact fitted to a fixed arm. On cooling down, the reverse operation takes place and circuit is made afresh. Owing to the fact that the "on" period is a small part only of the complete time cycle, the average loading when left on dry is low, being somewhat less than 100 W. When heating up from cold without water, the circuit is opened in approximately 40/50 sec.

The makers have carried out a boiling time and efficiency test during which the 1,500-W element boiled 3 pints of water from 62 deg. in 7.4 minutes.

Tests have been made on the 1,500-W elements up to 1,200 hours with the kettle dry. With a typical time cycle of 2.77 min. this would represent 19,000 makes and breaks. The contacts and device after such tests have been found to be in perfect condition with little or no change in the time cycle. The possibility was not overlooked of the contacts welding up in such cases where a kettle was in continuous use without ever being boiled dry. A test was accordingly made on an element fitted to a water tank, it being run for 1,000 hours without any disturbance or break of the contacts. At the end of this time the water was carefully run off and the element run dry, when it responded freely and opened circuit in the same time as at the commencement of the test.

Various models are available at a price lower than previous Premier kettles, and include 2-pint 750-W, 3-pint 1,000 or 1,500-W and 4-pint 1,500-W in aluminium copper, nickel plate and chromium plate.

Television Unit

A compact "add-on" television unit for use in conjunction with existing radio sets and speakers is announced by E. K. COLE, LTD., Southend-on-Sea. The three chassis, incorporating eighteen valves, and mounted as a single steel-rod scaffold which can be withdrawn very simply from the cabinet for service, in which case the scaffold acts as a service "cradle." One chassis contains the power pack, the receiver chassis (eleven valves) has pre-tuned vision and sound circuits, while the third chassis contains the two scanning units.

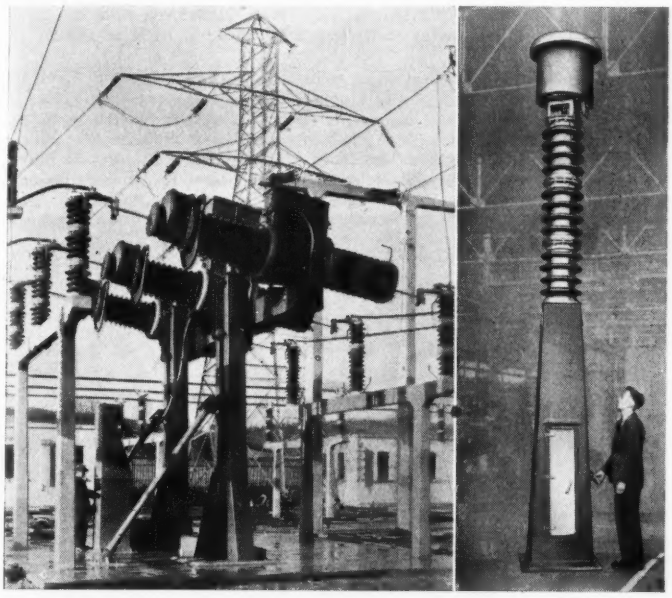
There are three main controls for contrast, brilliance and on-off, and focus all below the screen at the front of the cabinet. At the rear are four pre-set controls for picture height and width, line hold and frame hold. Also at the rear are output sockets for connection to radio pick-up sockets, dipole aerial socket and supply.

Electrical Works Activities

Further noteworthy contracts

Metropolitan-Vickers Electrical Co., Ltd.

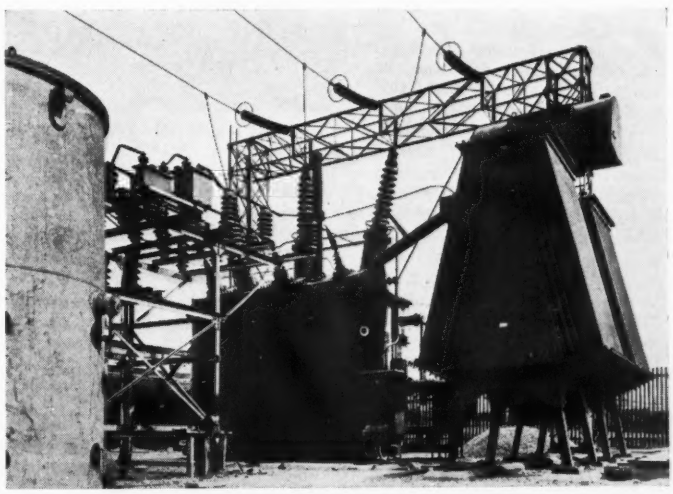
ONE of the most obviously interesting pieces of work in the comprehensive range the Metropolitan-Vickers Electrical Co., Ltd., now has in hand is the second 1,900 lb. per sq. in. turbo-alternator set for Brimsdown "A" (Northmet). This will comprise a two-cylinder primary turbine driving a 19,500-kVA alternator exhausting to a two-cylinder condensing turbine driving a 43,600-kVA alternator; both alternators are to be wound for 33 kV and will run at 3,000 RPM. Five-stage feed heaters are among the components. More in the conventional order of things is the repeat order for a 50,000-kW set for Blackburn Meadows (Sheffield Corporation) and a 20,400-kW set for Plymouth Corporation. Apart from such large examples, there are twenty-eight self-contained industrial generating sets under construction, one of which (3,000 kW) is a pass-out turbine driving a 2,000-kW alternator and a 1,000-kW DC generator for a paper mill.



Left: Metrovick 132-kV impulse-type circuit-breaker at the Lydney main sub-station of the Central Board. Right: Carrier-current line coupling condenser and line trap

Transformers in course of manufacture include duplicate 62,500-kVA 11/33-kV ON/OFB units for Sheffield Corporation, two single-phase 6.6/23-kV OFW sets for Deptford West (London Power Co.), one of 25,000 kVA 6.6/33-kV for Plymouth and two of 30,000-kVA 132/33, ON/OFB, for the Central Electricity Board's S.E. England scheme. Among those intended for export are two rated at 12,000 kVA with fans supplying air blast direct on to the cooling tubes of their steel tanks.

There are also a number of 110-kV transformers for India which are to be impulse tested. A sustained demand for on-load tap-changing is reported. Electric-furnace transformers include a 6,000-kVA three-phase unit for supplying at from 86 to 220 V in seven steps by means of a motor-operated off-circuit star-delta tapping switch on to separate intertwined winding on the 33-kV primary that spans the whole length of the core leg; an oil conservator is fitted so that a Buchholz relay can be used.



A 30,000-kVA 3-phase 132/33-kV B.E.T. transformer for outdoor service installed at Corby

Several compact distribution transformers for overseas are filled with non-inflammable "Traffodol." For one locality troubled with lightning the 6.6-kV transformers are fitted with surge-diverter terminal bushings. A new type of mining transformer with ratings of from 50 to 300 kVA has been designed to comply in advance with the new edition of B.S.S. 355 which will be issued shortly. Another new development is the "Thermac" AC welder with ratings of 200 and 300 A (dry type) and up to 440 A (oil cooled). A new "Transreg" voltage regulator up to 11 kV, which incorporates a moving core traversing the field of two stationary windings is in production.

In the busy instrument transformer section are a dozen capacitor voltage transformers, based on the principle of the condenser voltage divider, for use in connection with carrier current protection on the grid. For the Battersea "B" station twenty-five 66-kV voltage transformers for use with metal-clad switchgear are under construction.

Circuit-breakers of the impulse type at 132 kV are being built for the new Littlebrook station and of the single-break type at 66 kV for Battersea "B." Orders for 110- and 66-kV outdoor mounting circuit-breakers for New Zealand down to 6.6-kV pole mounting units for rural distribution are also features of the switchgear department. In addition to new work many older switches are being reconstructed with cross-jet explosion pots to improve their performance on short circuit.

Among the large synchronous induction motors in the shops, reference may be made to those with special excitation designed to give high efficiency with heavy overload. DC motors are also in demand for use with the Ward Leonard system for mills and winders; one of these equipments is an automatic geared winder, the components of which have an aggregate HP of 6,400. A silent motor unit has been developed as an alternative to the AC commutator machine for high speed lifts; it consists of a slip-ring and squirrel-cage machine on the same shaft, the former for starting and running and the latter for slowing and levelling periods. The range of motors with water-cooled air-coolers (for use where air pipes cannot be arranged) has been extended.

The manufacture of seventy-three further "Metadyne" train control units for the London Underground is in full swing. Another activity of the traction department is the fulfilment of the order by the L.N.E.R. for the 1,500-V equipment of seventy main-line mixed traffic regenerative locomotives to be used on the Manchester-Sheffield-Wath line. Repeat orders for trolley-buses for Hull, Doncaster and the London Passenger Transport Board are also in hand as well as for battery vehicles.

Mention should be made of the research being carried out into alloy steels at temperatures up to 1,000 deg. F. and slot lining insulation, and also of the million-volt impulse generator nearing completion and its associated cathode-ray oscillograph which is being designed to record a frequency of 2,000 kc/s with an amplitude of 1 in. and a total time sweep of 1 microsecond per in. of traverse.

Crompton Parkinson, Ltd.

The sixtieth anniversary year of the founding of R. E. Crompton & Co., has been one in which the demand for the products of the modern concern known as Crompton Parkinson, Ltd., has been appropriately good. In none of the sections of the

company's business have the effects of this been more pronounced than the traction department, which has had to be extended both at Chelmsford and at Brighton (Allen West & Co., Ltd.). Conspicuous in this connection are the 800 motors that are being built for a new type of six-car train for the London Underground together with partial control gear which is being supplied through the B.T.H. Co.; a feature of this equipment is that it is accommodated below the normal height of the trailer-coach floor, thus increasing passenger space.

Orders for trolley-bus electrical equipment are more numerous than ever and include gear for Rangoon, Capetown and Penang, as well as many home undertakings. Among the latter are forty-four on A.E.C. chassis for the Brighton conversion from tramways, in which all control apparatus is on a single panel, and a repeat order for tramcar equipment in Brazil.

Motors for industrial purposes are also being manufactured in large quantities. These include, in addition to the auto-synchronous machines which are proving effective in improving overall power factors, and the established designs, the "Tork E" range, which is claimed to develop any given starting torque with two-thirds of the current required by a standard machine, and the "Lowloss" model, giving high efficiency in continuous service. A third type in production has a reversing capacity in continuous duty of as much as forty times per minute, while a fourth is notable for its silent running. The new ⅛, ⅛ and ¼ HP "Minor" models (split-phase and capacitor) are evidently proving popular; the ⅛ HP machine is said to give ½ HP torque and an efficiency of 63 per cent. is claimed for the ¼ HP split-phase machine.

Typical of the overseas orders in hand is one received through United Engineers, Ltd., for the General Hospital, Penang, comprising 156 distributor-type ceiling fans, 600 lamps and a 400-V three-phase control board of eight Klad units and another for alternators and switchgear for the F.M.S. Government's power station at Kuala Lipis. Further representative orders in brief are T.A.P. circuit breakers with compound-filled bus-bar chambers for the East Anglian E.S. Co., switchgear for Barnoldswick, a 45,000-kVA, 132/33-kV ON/OFB transformer for the C.E.B. and switchgear and transformers for John Barkers, Kensington. Ammeters and voltmeters (some with illuminated dials) for the *Queen Elizabeth* and the *Mauretania* are features of the instrument department's recent work. New switchgear offices at Chelmsford have been brought into use and the new lamp works at Guiseley with a capacity of 250,000 lamps per day is now in full production; "Neophan" lighting units are in demand especially those of the new anodic aluminium type.

General Electric Co., Ltd.

Strength in the export field in its varied products is also reported by the General Electric Co., Ltd., as exemplified in a power house contract for Turkey, electrification of paper mills in India and a grain elevator scheme for Argentina, which includes 250 motors with a total capacity of 8,000 HP. Heavy engineering plant is represented by 3,000-RPM alternators of 35,000 kVA and upwards for direct coupling to Fraser and Chalmers steam turbines. Two 40,000-kVA sets for Johannesburg will bring the total G.E.C. units there to nine. The stator of a 37,500-kVA machine for Woolwich is being wound for 22 kV.

Of the many large transformers built recently a 45,000-kVA 132/33-kV unit for the C.E.B. is the most notable. A typical order for overseas is for fourteen 1,000-kVA single-phase transformers with on-load tap changing. Arc-control pots are now being fitted to circuit-breakers of smaller capacity than before, increasing the capacity for the same dimensions and greatly reducing arcing time. Many of the 132-kV 1,500-MVA breakers supplied to the C.E.B. from 1928 onwards have been modified in this way and a breaker of this type has been tested at over 2,000 MVA. The three phases of 66-kV 1,000 MVA breakers for the Gold Coast are accommodated in a single round tank. An 11-kV metal-clad switchboard for the Clyde Valley Power Co. has 1,000-MVA 2,000-A breakers that are capable of making 52.6 and breaking 134 kA.

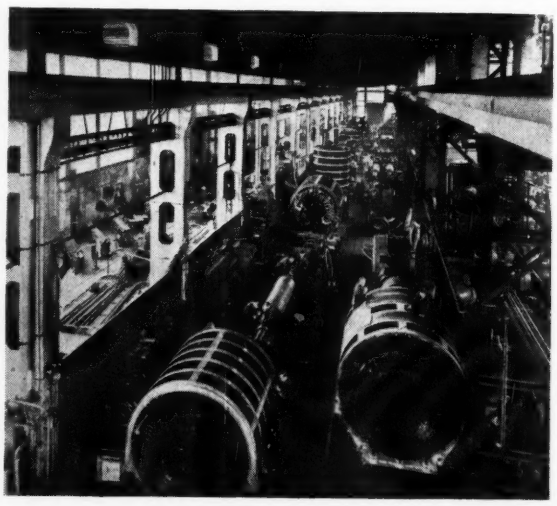
A lightning arrestor, to be installed at the C.E.B. 132-kV sub-station at Barking, consists of ten standards surge-valve units with a triple set of rings arranged umbrella fashion for equalising the grading and giving the required spark-over value. An 11-kV arc-suppression coil nearing completion is designed to pass 135 A, this being the maximum earth capacitative current of two healthy phases under earth-fault conditions.

Increasing use of the trolley-bus all over the world is reflected in equipments for Australia, South Africa, London and Lancashire. A new pantograph has been designed for multiple unit trains for speeds up to 65 miles per hr. Pumpless, air-cooled rectifiers up to 15,000 kW at 3,000 V in single cylinders are in demand all over the world. An outstanding contract is for the L.P.T.B., which calls for 88 rectifiers with a total output of 37,000 kW, 22-kV stone-cubicle switchgear, twenty-two 2,000-kVA transformers and over eighty high-speed circuit-breakers. The ventilating system of the rectifier has been simplified so that power taken by the fan has been reduced.

The design of AC totally enclosed fan-cooled motors above 50 HP at 1,500 RPM has been improved by exposing the whole of the stator to external air.

Squirrel-cage motors are under construction for work that requires high starting torque and the ability to withstand stalling for 20 sec.; the latter condition has called for an entirely heatproof stator winding and a rotor winding of heavy section resistance alloy. Additional sizes of totally enclosed DC machines have been introduced and the range of these now extends from 3 HP at 1,000 RPM to 150 HP at 350 RPM.

As an illustration of industrial work, there are in hand for a large steel works ninety DC motors aggregating 3,000 HP for driving auxiliaries, over 200 low-frequency roller motors, two 700-HP reactance-started synchronous motors driving Ward-Leonard control sets, two 1,500-kW 220-V motor generators, a 385-HP frequency changer and two flatback switchboards.



The turbo bay of the G.E.C. works, Witton, showing 3,000 RPM alternators for Johannesburg, Darlington, Woolwich, Stepney and Stockport

A contract for the Rand includes four 1,750-HP Ward-Leonard winder motors and two 2,600-kW motor generators. A tin-dredging scheme in hand for the F.M.S. calls for twenty induction motors of from 5 to 450 HP aggregating 1,800 HP, and thirty-two DC motors totalling 400 HP with plural starting apparatus.

An addition to the range of arc welding equipment is a light-weight single-operator unit for currents up to 150 A.

In the lighting section, in addition to the recent developments in discharge lamps and other items that are common to several manufacturers, a safety fuse within the cap of miners' lamps should be mentioned. The life of Claudegen high-voltage CO_2 discharge units has been doubled and a 250-W semi-decorative pattern for shops and a 1,000-W pattern suitable for wall-mounting over benches have been introduced.

At the cable works 66-kV three-core oil-filled cable of the type laid for the C.E.B. is being manufactured for Edmundsons and the City of Coventry. Telephone cables of the 24-pair carrier type with 36 speech channels per circuit and co-axial cable are among the further products of interest.

Yarrow & Co., Ltd.

The most interesting of the contracts of Yarrow & Co. from the electrical point of view, now that the Dalmarnock extension is out of the way, relates to the Greenwich generating station of the London Passenger Transport Board, the capacity of efficient generating plant at which is being brought up to 112,000 kW. Additional steam is to be provided by sixteen new boilers (eight in the first section, the first of which went into commission earlier in the year) each having a normal evaporative capacity of 50,000 lb. per hr. with 65,000 lb. as its maximum continuous rating.

These will supplement the output of ten older boilers of the same capacity and make, and will operate under the same steam conditions, *viz.*, 425 lb. per sq. in. and 780 deg.

Personal and Social

Information regarding new appointments and other matters of interest for this page are welcomed

MEMBERS of the Henletel Social and Athletic Club held their third annual Christmas party in the City Temple large hall on December 19th, when between 200 and 300 indulged in dancing and games. Included in the company were Sir Montague Hughman and Messrs. W. F. Bishop, A. M. Jacob, C. E. Rhodes and D. I. Evans. The programme included an excellent pantomime, "Henleyite and the Seven Dwarfs," written and produced by Mr. A. S. Brewer, of Henley's Advertising Department. The large number of toys which members took for the Christmas tree were later disposed of to children in Clerkenwell and the Queen's Hospital, Hackney.

Fulham Corporation Electricity Committee recommends the appointment of **Mr. A. A. Morris,** of Mitcham, as supervising assistant contract engineer, **Mr. E. Mumford,** of Raynes Park, and **Mr. R. C. D. Patterson,** of Heston, as assistant contract engineers, **Mr. E. F. Roper,** of Manchester, as electrical tester, **Mr. C. N. Melton,** of Grimsby, as street lighting inspector and **Mr. P. Briggs,** of East Sheen, as assistant mechanical maintenance engineer.

As a result of the continued increase in the volume of business from London and the Home Counties, M. & C. Switchgear, Ltd. has appointed **Mr. J. M. Hodge** assistant to its London manager, Mr. W. D. Murray, at 36, Victoria Street, S.W.1.

Mr. A. P. Good, who has been responsible for a number of reorganisations in the engineering industry, including the John Brown-Westland Aircraft-Petters-Brush Electrical deal, has disposed of his property holdings in order to concentrate on his engineering interests.

Mr. J. Hamilton was elected president of Birmingham Electric Club in succession to Mr. F. S. Ette, at the annual meeting of the Club held on December 19th. Other officers elected were Messrs. J. W. Donovan, senior vice-president; A. M. Fletcher, junior vice-president; M. J. Penfold, honorary treasurer; A. J. Haywood, honorary social secretary; and J. H. Asdell, honorary secretary. The annual reports states that the Club has completed thirty-four years and has a membership of 466.

For its twenty-fourth production the B.T.H. Operatic Society at Rugby recently gave a very successful presentation of "The Desert Song."

At the annual dinner and dance of the Midland Electric Manufacturing Co., Ltd., at Birmingham last Friday twenty-one further awards of gold watches were made to employés who had completed ten years' service. The total number of such awards to date is 180. The holders of these long-service awards presented to the managing director, **Mr. W. L. Barber,** an onyx desk set and perpetual calendar, together with an illuminated address of his founding of the firm.

The *London Gazette* of December 20th announces the appointment, as from November 5th, of **Major B. H. Leeson,** T.D., M.I.E.E., a director of A. Reyrolle & Co., Ltd., as Commanding Officer of the Tyne Electrical Engineers, R.E., with the rank of lieutenant-colonel, in succession to Lieut.-Col. R. P. Winter, M.C., T.D. Lieut.-Col. B. H. Leeson joined the Territorial Army on its formation in 1908 by enlisting in the London Electrical Engineers, R.E.(T.), and was on duty at the Coronation of King George V in 1911 and that of King George VI in 1937. In 1914 he transferred to the Royal Naval Division, and took part in the historic landing of the 29th Division on "W" Beach of the Gallipoli Peninsula on April 25th, 1915. In September he was invalided to Egypt, but returned to Gallipoli shortly before the evacuation in January, 1916. The Royal Naval Division then proceeded direct to the Western Front, where they were engaged in the battles of the Somme and the Ancre, including the capture of Beaumont Hamel in November, 1916. In 1917 he was transferred to the Tyne Electrical Engineers, R.E., at Gosport, and later was appointed to the Tyne defences. He was mentioned in dispatches and has the Territorial Efficiency Medal.

Mr. H. E. Blackiston, borough electrical engineer of Ipswich, has been appointed borough electrical engineer at Swansea. Mr. Blackiston served as a pupil at Horsham and in various capacities at Penarth and Nuneaton and with the Durham Electric Power Co. He was appointed district engineer for a large part of the South Wales Electric Power Co.'s system, and in 1919 came to London as sub-station superintendent to the L.C.C. Tramways, relinquishing that position in 1928 to join the Bermondsey undertaking as deputy chief electrical engineer. Mr. Blackiston left Bermondsey to take up the position of borough electrical engineer and transport manager of West Hartlepool and later obtained the appointment at Ipswich. He is chairman of the Ipswich and District Electrical Association and is a member of the I.E.E.

Mr. H. E. Blackiston

The Osram-G.E.C. Glass Works Social and Athletic Club held its annual dinner at the Clarendon Restaurant, Hammersmith Broadway, on December 17th. Mr. C. Wilson, managing director, attended, together with members of the executive staff of the Osram-G.E.C. Lamp Works, the M. O. Valve Co., Ltd., Claude-General Neon Lights, Ltd., and the Lemington Glass Works, Ltd.

The annual dinner and dance of J. H. Tucker & Co., Ltd., was held at the Imperial Hotel, Birmingham, on December 16th. Every section of the Tucker organisation was represented in the large gathering which assembled to do justice to Christmas fare in traditional style. Afterwards there was an excellent concert and dancing.

Members of the sales and works executives of the Lancashire Dynamo & Crypto organisation, which includes the Foster Engineering Co., Ltd., Crypton Equipment, Ltd., and Dynamo & Motor Repairs, Ltd., spent an enjoyable evening at Pagani's Restaurant recently on the occasion of the company's London dinner. The toast of "The Parent Company" was proposed by **Mr. M. V. Ely,** managing director of the Foster Engineering Co., Ltd., who emphasised the importance of loyalty to the firm. Responding, **Mr. H. W. Bosworth,** managing director of Lancashire Dynamo & Crypto, Ltd., referred to the various sections of the company's activities represented by those present. After the dinner an entertainment was provided by several well known artistes.

Members of the sales and works executives of the Lancashire Dynamo & Crypto organisation at dinner

It is proposed to make presentations to **Mr. H. B. Poynder,** hon. secretary to the North-Eastern Centre of the Institution of Electrical Engineers, and **Mr. H. R. Viall,** assistant secretary, on their retirement from these positions after eighteen and twenty years' service respectively. Subscriptions (maximum 5s.) should be sent to the assistant secretary, Mr. Geo. A. Kysh, not later than January 7th.

Obituary

Lady Hirst.—It is with the very deepest regret that we have to announce the death of Lady Hirst in London on December 22nd. The whole of the electrical industry will unite in offering very sincere sympathy to Lord Hirst and his family in their great loss. Lady Hirst will be sadly missed, too, by the employés of the G.E.C., whose interests were her own. She always supported the many social activities of the company's employés and it was always a sincere pleasure to them to see her at Wembley on the occasion of the annual sports, when it was her custom to present the prizes. The funeral, which took place on December 24th, was strictly private.

Mr. E. Parry.—Mr. Evan Parry, a partner in the firm of Preece, Cardew & Rider, consulting engineers, whose death occurred on December 17th, was born in 1865 at Llanberis, Carnarvonshire. After serving five years with Winton & Co.,

marine engineers, Carnarvon, during which time he obtained a Whitworth Exhibition in 1888. He proceeded in 1890 to the Glasgow University where he studied under the late Lord Kelvin. During the latter part of his time at Glasgow he acted as demonstrator in the Physical Laboratory. He obtained a B.Sc. degree in civil engineering and mechanics.

From 1893 to 1895 he acted as assistant engineer and manager to the City of London Electric Lighting Co., and in 1895 he joined the British Thomson-Houston Co., Ltd., as a designer of electrical machinery, &c. From 1897 to 1910 he was chief assistant to Dr. H. F. Parshall, consulting engineer, during which time he was engaged in the design and supervision of the electrical equipment of the Central London Railway, and the Dublin, Bristol, London United, Glasgow Corporation and other tramways. He was also connected with the early stages, under Dr. Parshall, of the Yorkshire Electric Power Co., and of the Lancashire Electric Power Co. In 1910 he went to New Zealand to take up the appointment of chief electrical engineer to the Public Works Department, and during the following ten years he was responsible for the development of various hydro-electric undertakings in the North and South Island. The Lake Coleridge scheme was constructed under his supervision and a great deal of the preliminary work was carried out in connection with the Arapuni, Mangahao and other power schemes. He retired from the New Zealand Government Service in 1919 to join the English Electric Co. in London as chief engineer, but in 1924 he resigned in order to join Preece, Cardew & Rider as a partner. Since 1924 Mr. Parry has been engaged in a large number of electricity supply schemes in different parts of the world. Among the many works for which he was responsible was the power station of the Uhl River scheme in the Punjab. He made numerous visits to Ceylon in connection with development of hydro-electric work in that Island and including a large scheme at Watawala, tenders for which are now being called. Mr. Parry paid a visit to Australia and New Zealand early in 1938 in connection with work his firm has in hand for Sydney, Adelaide and Melbourne, and numerous schemes in New Zealand.

Col. D. Bates.—We regret to announce the death on December 17th, at the age of seventy-two, of Colonel Darwin Bates, who for thirty-seven years was works manager of the Prescot works of British Insulated Cables, Ltd., and played a prominent part in the growth of the company. After serving his apprenticeship with the Silvertown Co., he joined the staff of the City of London Electric Lighting Co., and in 1896 went to the B.I. as works manager, a position which he held until his retirement in 1933. Colonel Bates was a member of the I.E.E., a keen volunteer and territorial, a J.P. and Deputy Lieutenant of the County of Lancaster. In the early years of the war he was promoted to the rank of lt.-colonel and given command of the 2/5th Battalion of the South Lancashire Regiment, with which unit he went to France. He leaves a widow and a son and daughter.

The late Col. D. Bates

American-Canadian Trade Agreement

British preference generally maintained

WE have received from the British Electrical and Allied Manufacturers' Association a statement relating to the electrical part of the Canadian-United States Trade Treaty signed by representatives of the two countries at Washington on November 17th.

The new Canadian Customs duties to be imposed on electrical goods of United States manufacture on and after January 1st, 1939, are shown in the appended table. In a number of cases these are lower than the present duties, and the preference hitherto enjoyed by British manufacturers is reduced. The Anglo-Canadian Trade Agreement of February 23rd, 1937, guarantees British manufacturers a definite preference in certain cases, and these guarantees appear to have been satisfied without the necessity of any reduction in the British duties.

One anomaly, however, remains; in the case of Tariff Item ex 197 (cable insulating paper) the new duty on American goods is, it would appear, to be less than the present duty on British goods. In accordance with most-favoured-nation agreements the British duty should be reduced to the same level as the new American duty (10 per cent.). Moreover, if these goods are not manufactured in Canada, British manufacturers are entitled to the preference of 7½ per cent. under the Anglo-Canadian Agreement (Article 7); the British preferential tariff would then be 2½ per cent. at most. It is stated that advices are still awaited from Ottawa in respect of the items under review.

ITEMS ON WHICH MAXIMUM CANADIAN DUTIES ARE FIXED UNDER THE AGREEMENT.

Canadian Tariff Item No.		Duty on U.S. goods. Old, per cent.	Duty on U.S. goods. New, per cent.	Present British preferential tariff, per cent.
192*d*	Electrical insulating pressboard, not less than .040 in. in thickness	25	12½	Free
ex 197	Electric cable insulating paper, .0045 in. or less in thickness, and condenser tissue paper	22½	10	15
237*c*	Synthetic resins, n.o.p. in liquid, powder, granular, or lump form; or in tubes, cylinders, strips, sheets, plates, blocks, bars, rods, angles, channels, tees or other shapes or sections, not further manufactured than moulded, extruded or pressed, when for use in Canadian manufactures	Free	Free	Free
315	Carbons or carbon electrodes over 3 in. in circumference or outside measurement and not exceeding 35 in. in circumference or outside measurement; carbons of a class or kind not produced in Canada, when imported for use in the manufacture of dry batteries and dry cells	Free	Free	Free
350	Wire of all metals and kinds, n.o.p. ...	30	30	10
351	Wire, single or several, covered with any material, including cable so covered, n.o.p.	27½	27½	20
368	Clocks, time recorders, clock movements, clockwork mechanisms, and clock cases	30	30	15
	But not less than ... ... each	50 cts.	40 cts.	—
369	Parts of clock movements or of clockwork mechanisms, finished or unfinished, not including plates	25	25	10
415	Electric vacuum cleaners and attachments therefor; hand vacuum cleaners; and complete parts of all the foregoing, including suction hose, n.o.p.	20	20	5
415*a*	Refrigerators, domestic or store, completely equipped or not: (i) Electric	30	25	20
415*b*	Washing machines, domestic, with or without motive power incorporated therein; complete parts of washing machines	25	25	15
415*d*	Sewing machines, with or without motive power incorporated therein; complete parts of sewing machines	15	15	5
427*h* ex 445*f* ex 445*k* ex 446*a*	Motion picture projectors, arc lamps for motion picture work, motion picture or theatrical spotlights, light effect machines, motion picture screens, portable motion picture projectors with or without sound equipment; electric rectifiers or generators designed for use with motion picture projectors; complete parts of all the foregoing, not to include electric light bulbs, tubes, or exciter lamps	15		Free
	427*h*			Free
	445*f*	30		15
	445*k*	25	15	15
	446*a*	27½		10
438*a*	Electric trackless trolley-buses; chassis for the foregoing	17½	17½	Free
443	Apparatus designed for cooking or for heating buildings: Electricity	25	25	15
445	Electric light fixtures and appliances, n.o.p., and complete parts thereof ...	30	27½	20
445*a*	Electric head, side and tail lights, n.o.p.; electric torches or flashlights and complete parts therefor	30	27½	20
445*c*	(i) Electric telegraph apparatus and complete parts thereof	25	25	Free
	(ii) Electric telephone apparatus and complete parts thereof	25	25	10
445*f*	Electric dynamos or generators and transformers, and complete parts thereof, n.o.p.	30	25	15
445*g*	Electric motors and complete parts thereof, n.o.p.	30	25	15
445*k*	Electrical apparatus and complete parts thereof, n.o.p.	25	25	15
445*n*	Electrical instruments and apparatus of precision of a class or kind not made in Canada, viz.: meters or gauges for indicating and/or recording altitudes, amperes, comparisons, capacity, density, depth, distance, electrolysis, flux, force, frequency, humidity, inductance, liquid levels, ohms, operation, power factor, pressure, space, speed, stress, synchronism, temperature, time, volts, volume, watts; complete parts thereof	25	17½	Free
446*g*	Electric welding apparatus, not including motors	25	20	10
509	Vulcanised fibre, kartavert, indurated fibre, and like material, and manufactures of, n.o.p.	22½	17½	17½
597*a*	Musical instruments of all kinds, n.o.p. phonographs, graphophones, gramophones and finished parts thereof, including cylinders and records therefor; and mechanical piano and organ players	24¾	25	15

Commercial and Industrial News

Slot Meter Patent. Anglo-German Discussions. Employment in November. Jute Research in India. City and Guilds Exams. E.D.A. January Programme. A.S.E.E. Meetings.

Meter Patent Amended

IN the Chancery Division on December 21st Mr. Justice Simonds gave judgment in an application by F. R. Butherus and British Sangamo Ltd. (now Sangamo Weston, Ltd.), Enfield, for leave to amend the complete specification of the letters patent No. 346,282 for an invention for "Improvements in Coin-freed Mechanism." The application by way of petition was opposed by the Electrical Apparatus Co., Ltd.

Mr. Trevor Watson, K.C., for the applicants, said the invention was chiefly concerned with shilling-in-the-slot electricity or gas meters, for which under modern housing schemes there was an increasing demand, and in the poorer districts it was desirable that a smaller amount than a shilling should be available to the consumer, and the object of the invention was to enable coins of different denomination to be used. The amendment of the specification was desired in order more clearly and accurately to define the scope of the monopoly claimed.

The specification described and illustrated the mechanism for supplying electricity or other commodity in varying amounts according to the size of the coins inserted. It was important to arrange for coins of different diameter; as for instance a penny, sixpence, or shilling which gave amounts of the commodity proportional to the value and not necessarily proportional to the diameter. It was also important that the mechanism should not work with coins other than those for which it was designed. These conditions were provided for by the invention.

A festive display at the Bristol showroom of the English Electric Co., Ltd.

The petition was opposed by the Electrical Apparatus Co., Ltd., on the ground that the amendments were not by way of disclaimer, correction or explanation and if allowed would make the specification different from the invention claimed in the specification as it stood.

The Assistant Controller of Patents allowed certain of the amendments applied for but disallowed others, and the petitioners now contended that the amendments refused ought to be permitted. His Lordship granted leave to make the amendments applied for.

Anglo-German Industrial Discussions

Informal discussions have recently taken place between officials of the Reichsgruppe Industrie, representing organised German industry and of the Federation of British Industries. The object of this meeting has been to ascertain whether there is a common basis on which official discussions could usefully take place between the two organisations, which might result in a mutual increase of trade between the two countries, and in agreements with regard to Anglo-German competition in home and third markets. It is satisfactory to note that this exchange of views showed that such a basis for discussion undoubtedly exists. The result of the meeting will be reported to the governing bodies of the two organisations, and if accepted by them, it is hoped that an official meeting between the two bodies may be convened early in the New Year, and arrangements made to bring into touch individual industries in the two countries which may be prepared to discuss the points at issue.

Colour Lighting Display

The members of the National Display Association and the Publicity Club of London recently attended a special colour lighting display in the Holophane theatre, Elverton Street. The guests were welcomed by Mr. M. C. Toner, publicity manager of Holophane, Ltd., who was responsible for organising the meeting. He outlined the direct connection between stage lighting and that of modern decorative display. Mr. R. G. Williams, head of the stage and colour lighting department, recounted the development of stage lighting from the earliest times, and stressed the coincident development of the electrical control which was an important feature of the elaborate colour lighting schemes of to-day. The lecture was illustrated by practical demonstrations on the stage wherein the different uses of colour on various displays were shown. Numerous concerted musical and dancing acts by members of the Corlett Repertory Company were a practical and entertaining feature of the evening. At the conclusion of the lecture Mr. W. H. Newman, of the National Display Association, thanked Mr. Williams and the Holophane Co. for an instructive evening.

Employment in November

Employment in the engineering industry between October 17th and November 14th showed little change and continued fair on the whole, being good in electrical engineering. According to the *Ministry of Labour Gazette*, the number of unemployed in the engineering industry at November 14th was 92,564, a decrease of 1,193 as compared with the preceding month, but an increase of 29,864 as compared with the corresponding date in the previous year. In electrical engineering there were 6,181 unemployed, the percentage rising from 5.2 to 5.3 (3.1 per cent. in November, 1937). In the electrical wiring and contracting section the unemployed totalled 4,087 or 9.6 per cent. (9.5 per cent. in October and 8.8 per cent. in November, 1937). The total out of work in the electric cable, apparatus, lamps, &c., group was 12,081, the percentage remaining at 6.7 as compared with October and showing an increase of 0.9 per cent., as compared with November, 1937.

B.I.F. Catalogue

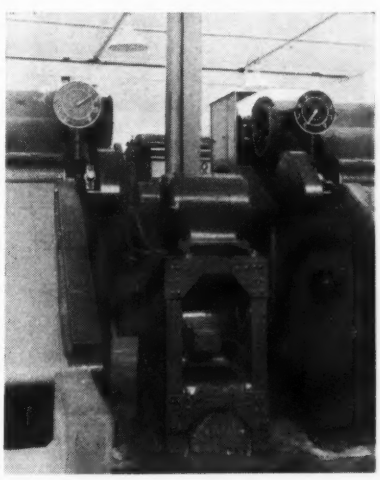
The advance edition of the London Section catalogue of the 1939 British Industries Fair is now being issued. All told 14,000 catalogues, indexed in nine languages, have been dispatched to seventy-five countries. The issue of the advance catalogue follows an intensive campaign which includes the posting to all parts of the world of 1,870,000 booklets, posters, and "reminder" cards. In addition nearly half-a-million letters in ten languages have been sent out telling buyers of travel concessions and other facilities available to Britain's overseas trade guests. The advance catalogue of the sections of the Fair at Olympia and Earls Court contains practically a full list of exhibitors and a classified index of products arranged according to groups. The advance list of the exhibitors in the Engineering and Hardware Section is now being sent to buyers in large numbers of overseas markets.

A Large Telephone Contract

The Automatic Telephone & Electric Co., Ltd., and the Engineering Co. of Portugal, Ltd., have received a contract valued at £650,000 for automatic and semi-automatic Government telephone exchanges in Portugal.

Indian Jute Research Laboratories

To facilitate scientific research, particularly with regard to fixing the spinning value of its agricultural products, the Indian Central Jute Committee has opened technological research laboratories equipped with spinning machinery similar to that in any up-to-date electrically driven jute mill, with the exception that some of the units are sub-standard so far as size is concerned. The electric drives for the various machines are from eleven motors manufactured by Crompton Parkinson, Ltd., and supplied through their Indian agents, Greaves, Cotton & Co., Ltd. A transformer, switchgear, thirty-three ceiling fans and regulators, with 56-in. sweep, and Crompton lamps were also supplied. Most of the machinery was manufactured by James F. Low & Co., Ltd., and Fairbairn, Lawson, Combe Barbour, Ltd. The former supplied a waste breaker card, breaker cards for warp and weft, and finished cards as well as two drawing frames, and the latter company a roving frame and



Breaker cards at the Indian jute research laboratories driven by 10-HP "Klosd" slip-ring induction motors

two spinning frames. The waste breaker card for dealing with heavy root ends, waste material, &c., is V-rope driven by a "Klosd" slip-ring induction motor of 10 HP at 940 RPM, with slip-ring short-circuiting gear. The J. F. Low breaker cards are driven by motors of similar capacity and the finisher cards by "Textork" induction motors of 7.5 BHP at 960 RPM. Similar motors are used for driving the drawing frames.

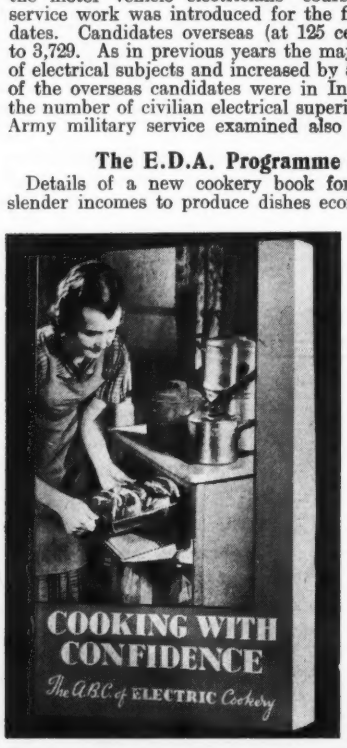
The three machines supplied by Fairbairn, Lawson, Combe Barbour, Ltd., are small editions of their standard sizes. The roving frame, for instance, which prepares a slackly twisted yarn (rove) as a preliminary stage has for experimental purposes been made to prepare rove both for hessian and sacking warp and weft yarns. Spinning frames and the roving frames are driven by "Textork Klosd" motors and controlled by Donovan primary resistance starters with "stop," "start," and "inch" push-buttons. The softener, of Douglas Fraser manufacture, referred to as a "mangle," is used for softening the jute and treating it with oil and water prior to passing to the grading machines. It is driven by a "Klosd" slip-ring induction motor of 10 BHP at 940 RPM with slip-ring short-circuiting gear. The 200-kVA, three-phase, 50-cycle transformer is of the B.E.T. core type for indoor service, in a tubular boiler-plate tank, with a no-load ratio of 6,000-400 V and delta-star connected. The high voltage tappings are at plus and minus 2½ and 5 per cent. It is fitted with an off-load tapping switch, silica gel breather and the usual standard fittings. The switchgear comprises a four-unit "A" form "Klad" board for 400 V, three-phase, four-wire, 50 cycles, to control the incoming transformer and three outgoing feeders.

City and Guilds Institute Examinations

The Department of Technology of the City and Guilds of London Institute conducts examinations (in general at two stages, intermediate and final), in technological and ancillary subjects covering most of the staple trades and industries. The annual report for the session ended September, 1938, shows that there were 33,361 candidates that year, an increase of 21 per cent. on the 1937 total. The examinations for teachers' certificates were taken by 2,519 candidates, a decrease of one per cent. The examinations are held at 501 centres at home and also within the Empire overseas, the number of subjects in 1938 being 152. Candidates for telecommunications numbered 13,217, a net increase of 3,774, the only decrease (292) being recorded in the telegraphy candidates (944). Those for electrical engineering practice increased by 155 to 810, those for electrical installation work by 134 to 511 and those for the motor vehicle electricians' course by 48 to 200; radio service work was introduced for the first time with 84 candidates. Candidates overseas (at 125 centres) increased by 518 to 3,729. As in previous years the majority were in the group of electrical subjects and increased by 500 to 2,500. Two-thirds of the overseas candidates were in India, an increase of 240; the number of civilian electrical superintendents in the Indian Army military service examined also increased.

The E.D.A. Programme for January

Details of a new cookery book for helping families with slender incomes to produce dishes economically are contained in the British Electrical Development Association's sales and publicity programme for January. There has been a big demand for the E.D.A. calendar for 1939 and the attractive calendar blotters make excellent enclosures in foolscap account envelopes, &c.



The new E.D.A. cookery book

The water heater poster "Piping hot and plenty of it" is now available in 16-sheet size.

Domestic Science Examinations

The London School of Electrical Domestic Science announces that twenty-three students sat for the final examinations in December. Of these seventeen sat for the demonstrator's certificate, two gaining distinction certificates and receiving the silver medal offered by Miss Minoprio for an average mark of 85 per cent. or over; four gained first-class and four second-class certificates. Five students sat for the electrical domestic science certificate, one gaining a second-class certificate and one a first-class housewive's certificate.

Anti-corrosion Process

An anti-corrosion process introduced by International Corrodeless, Ltd., Windsor House, 46, Victoria Street, London, S.W.1, partly depends, in common with many others, on the deposition of stable metals on the base metal that has to be protected. Whereas hitherto the aim has been to deposit a thick layer, of a depth relative to the degree of permanence, the "Roval" process is said to alter the surface character of the metal to which it is applied. An electrolytic bath of a special kind is employed with complex electrodes which are claimed to cause an alloy of metals which are themselves resistant to be deposited. The use of accelerators is thought to increase the speed of the impinging particles, making them penetrate the metal pores which otherwise would hold attacking fluids and gases. The surface is thus enabled to withstand the formation of oxides or other salts produced by decomposition. Since the "Roval" process consists in filling-up rather than building-up, there is no necessity for the protective sheath to be of any appreciable thickness. Thus the dimensions of articles treated are claimed to be virtually unaltered, so that subsequent machining is obviated. For example, the fit of precision screw threads is not impaired and, furthermore, simple preliminary pickling suffices.

Worm Gear Manufacturers' Showroom

Following the replanning and reorganisation which has been going on at Park Works for some time, the worm gear drawing office, adjacent the main entrance of the works of David Brown & Sons (Hudd.), Ltd., has been converted into an imposing reception room. The decoration of the room is carried out in primrose yellow, and the floor, panelling and exhibition stands in light polished oak. The room contains a wide and interesting range of products, representative of the

The new reception room at the works of David Brown & Sons (Hudd.), Ltd.

entire organisation. Round the walls are framed photographic enlargements of exterior and interior views of the works. The display stands are representative of each division of the organisation, and the accompanying showcards and lists indicate the main products of each section. One of the most interesting displays is that in the historical section, which, besides reflecting the long history of the organisation, traces the progress made in gearing over a period of nearly 120 years.

A Novel Paper Weight

A one-eighth scale model of a 5-HP electric motor made from a plastic material with an ivory base will be sent (one only) by Brook Motors, Ltd., Huddersfield, to any reader sending 6d. in stamps to cover the expense of postage. No advertising matter appears on the motor, which serves as a paper weight, and the pulley which holds leads for propelling pencils can be removed. The model is packed in a cardboard representation of a packing case and with it comes a reminder of the company's offer to exchange a new motor for an old one of any make or condition at a discount of up to 50 per cent.

Furnace Manufacturer's Decision

With the advent of the radiant tube gas-fired heating element Birmingham Electric Furnaces, Ltd., have decided to manufacture certain types of mechanically operated gas-fired furnaces as an alternative to electric models. In some circumstances a combination of electric and gas heating will be offered.

Eire Lamp Import Quota

The new quota for the importation of electric lamps into Eire under the Control of Imports Acts has been fixed at 25,000 for the period February 1st to July 31st, 1939.

A.S.E.E. Programme

Due to the bereavements suffered by Mr. J. C. Dalton, who was to have given a paper on "The Electricity Commissioners in Relation to the Powers of Supply Authorities" at the meeting of the Association of Supervising Electrical Engineers on December 20th, and also on account of the very inclement weather, it was decided to postpone this meeting. This has

necessitated certain readjustments and for 1939 the Association's programme should read as follows:—

January 17th: "Electrical Medical Apparatus," by Mr. J. L. Baxter. February 21st: "I.E.E. Regulations for the Electrical Equipment of Buildings," by Mr. Alan Kirk, A.M.I.E.E. February 25th: Annual dinner and reunion, Trocadero Restaurant, W.1 (6.30 for 7 p.m.). March 21st: "The Electricity Commissioners and the Exercise of their Powers in Relation to Public Supply Authorities," by Mr. J. C. Dalton, A.M.I.E.E. April 18th: "Electricity in Relation to Public Services," by Mr. Forbes Jackson, M.I.E.E. The meetings will be held at the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, commencing at 7.15 p.m.

Motor Works Film

Higgs Motors, Ltd., have taken a film of the various departments of their works depicting the manufacturing processes of electric motors and dynamos. Apart from being of considerable educational value, it is also of general interest. The company is prepared to lend this film free of charge to any recognised engineering society or body interested. The film is in two spools and lasts for approximately half an hour and is the standard 16 millimetre Kodak size.

Gas to be Dearer

It was announced last week that the Gas, Light and Coke Co., Ltd., is to increase the price of gas by ¾d. a therm as from March 1st next. A year ago the price was raised by 0.3d. a therm.

Motor Braking

An interesting system of connecting a three-phase shunt motor to permit it to be used as a brake for stopping machines is particularly useful for textile and papermaking plant and machine tools, in which cases speedy braking may save considerable quantities of material from being spoiled. The system of putting the motor into reverse has been used, but this carries with it the danger of re-starting the driven machine backwards. Siemens (Berlin) propose to connect the two poles of a DC circuit to two of the phases of the motor. This serves merely to cover the voltage drop in the primary winding, which is a very small proportion of the total voltage of the three phases. The DC can, therefore, be supplied by a small copper-oxide rectifier which, on account of the short duration of its operation, stands up very well. An additional resistance between the collector brush and the stator winding, increasing the resistance of the secondary winding, acts on the short-circuit current in the latter and shortens the time required for stopping the driven machinery very considerably.

New Parliamentary Bills

We publish below a list of proposals of an electrical nature which will come forward in the ensuing session of Parliament. Readers who are desirous of obtaining further information will find the notices in the *London Gazette* for December 6th and 9th.

Tynemouth, Walsall and Oswestry Corporations.—Further powers in relation to their respective electricity undertakings.

Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board.—A Bill to authorise the Board to acquire from the Urban Electric Supply Co., Ltd., the undertaking authorised by the Glossop Corporation Electric Lighting Order, 1899; to enter into agreements with the Central Electricity Board in regard to the terms and conditions applicable to the supply of electricity to the undertaking after its acquisition by the Board; to extend the Board's area of electricity supply and for other purposes.

North Metropolitan Electric Power Supply Co.—Further powers on, and to change the name of, the North Metropolitan Electric Power Supply Co., and for other purposes.

Macclesfield Corporation.—To purchase part of the undertaking of the Electricity Co. of Macclesfield, Ltd.

London Passenger Transport Board.—To empower the Board to provide certain services of trolley vehicles, and for other purposes.

Wholesalers' Dinner

The annual dinner of the Electrical Wholesalers' Federation is to be held at the Savoy Hotel, London, on March 16th.

Chemical Symbols

There has just been issued a standard list of chemical symbols and abbreviations based on the report of a Joint Committee of the Chemical, Faraday and Physical Societies which embodies the agreed views of British physicists and chemists. The list is divided into a number of sections, including electricity and magnetism, and copies may be had from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 3s. 8d. post free.

Calendars, Diaries, etc.

"The Fragrance of Spring," a still life picture of narcissi and violets, makes a tasteful illustration for the calendar of the Hart Accumulator Co., Ltd., which has monthly sheets showing the preceding and following months.

A reproduction from a photograph of Heath Old Hall, near Wakefield, has been chosen by the British Jeffrey-Diamond, Ltd., for its 1939 calendar.

The calendar of Milne and Longbottom has a charming picture on silk of a dainty little maid in crinolines, with the title, "Her Day."

Bull Motors (branch of E. R. & F. Turner), Ltd., has sent us a calendar with a cut-out of the company's familiar trade mark, below which are illustrated three of the company's motors. The monthly sheets show the preceding and following months.

The diary received from the London Electric Supply Corporation, Ltd., is bound in dark red leatherette, and in addition to the usual diary information, contains a good deal of useful facts for electricity consumers. A thumb index facilitates reference to the various months.

The block calendar of the British Vacuum Cleaner and Engineering Co., Ltd., has a gay little goblin leaping over a globe.

The County of London Electric Supply Co., Ltd., has again selected twelve well-executed humorous drawings in colour for its calendar, which has monthly sheets.

Falk, Stadelmann & Co., Ltd., illustrate some typical examples of lighting installations designed by their illuminating engineering department on the monthly sheets of their calendar.

The wall calendar of T. J. Grainger & Co., Ltd., has large daily slips with bold red figures mounted on a strong board drawing attention to some of the products of the company.

The Automatic Telephone & Electric Co., Ltd., has again sent us a neat propelling pencil with a red case and refills.

Aveling-Barford, Ltd., are issuing a loose-leaf note-book which can be conveniently carried in the pocket.

A useful stainless steel pocket knife has been received from the Standard Fuse Co.

Francis Polden & Co., Ltd., have sent us a diary bound in dark red leatherette with pockets and also an at-a-glance calendar.

The block calendar of Lindsay & Williams, Ltd., has bold red figures.

The tasteful calendar of Christy Bros. & Co., Ltd., is embellished by a picture on silk of a bright maiden on board a yacht.

The calendar of the Spencer Wire Co. has large daily slips each of which bears a quotation.

"Memories," a charming study by Albert H. Collings, which adorns the calendar received from Mr. Christopher Wade (Gabriel, Wade & English, Ltd.), shows a fair lady in pensive mood.

We wish to thank our many readers who have sent us the season's greetings which we heartily reciprocate.

G.E.C. cooking equipment at "Quaintways" Restaurant, Chester, showing (left) the all-electric kitchen and (right) the bakehouse (see page 932)

Trade Announcements

Best Products, Ltd., has opened a London office at 5-9, Quality Court, Chancery Lane, W.C.2 (telephone: Holborn 9329. Telegraphic address: Itzwright, Holborn, London), and Messrs. A. Wright and F. D. Lloyd have been appointed joint sales managers to the company. In future, all sales for home or export will be dealt with by the London office.

Messrs. Leo Swain, Autofax House, St. John Street, Deansgate, Manchester, have been appointed sole distributors for Great Britain of Ferranti condensers for motor car distributor heads.

La Mont Steam Generators

A 100-page booklet, on art paper and bound in a stiff cover, has been issued by John Thomson Water Tube Boilers, Ltd., covering "La Mont" steam generators, and including a 56-page appendix of information of interest to steam users. These boilers were described in the ELECTRICAL REVIEW of September 30th, test results being reported on December 2nd.

Electro-deposition Lectures

A course of four lectures on "A Decade of Progress in the Electro-Deposition of Metals," will be given by Mr. S. Wernick at the Northampton Polytechnic, London, E.C.1. The dates of the lectures are January 10th and 24th and February 7th and 21st.

New Catalogues and Lists

British Insulated Cables, Ltd., Prescot.—Leaflets dealing with condensers for electric-discharge lamps and 22-, 33- and 66-kV cables.

Ferranti, Ltd., Moston, Manchester, 10.—A pamphlet describing condensers for motor car distributor heads.

Senior Economisers, Ltd., 11, Southampton Row, London, W.C.1.—A 72-page illustrated art book, bound in a stiff cover, dealing with economisers. It is well illustrated and contains many elevation drawings.

Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.2.—A folder which describes the new "Sunlite" commercial lighting units.

Chloride Electrical Storage Co., Ltd., Exide Works, Clifton Junction, Manchester.—A list of some electric lighting installations equipped with the "Keepalite" emergency lighting system and a folder dealing with the floating battery system of emergency lighting for cinemas and theatres.

Durex Abrasives, Ltd., Arden Road, Adderley Park, Birmingham, 8.—Details of "Durex" electro-coated abrasives.

Private Arrangements

F. C. Bennett, trading as Bennett & Littlewood, radio and electrical engineer, Leeds Road, Bradford.—The creditors met recently at Bradford. No statement of affairs was submitted, but it was reported that the ranking liabilities amounted to £1,069. After allowing £36 for preferential claims the net assets were £4, leaving a deficiency of £1,065. Several creditors had commenced proceedings. It was decided that the matter should be left in the hands of J. E. Hartley & Co., accountants, Bradford.

Bankruptcy Proceedings

J. T. Wyer, 34, Hilderthorpe Road, Bridlington, electrician and wireless dealer, trading as East Coast Electrical Services.—The first meeting of the creditors of the above was held on December 20th at the Official Receiver's offices, Bank Chambers, Scarborough, when the statement of affairs disclosed gross liabilities of £234, of which £67 was expected to rank for dividend, with net assets of 11s., leaving a deficiency of £66. The debtor attributed his failure to insufficient business to cover expenses. The case being a summary one was left in the hands of the Official Receiver as trustee.

D. Beck (Electrical and Hardware Appliances), electrical appliances dealer, "Kebroyd," Ings Lane, Guiseley, formerly carrying on business at 96, Harris Street, Bradford, now out of business.—First meeting January 2nd at 24, Bond Street, Leeds. Public examination January 24th at the County Court House, Leeds.

E. Nelson, electrician (E. Nelson & Son), 63, Wharton Street, South Shields.—Trustee, Mr. P. J. McLellan, 81, St. Mary's Place, Newcastle-on-Tyne, Official Receiver, released December 7th.

J. H. Metcalf, radio dealer, 82, Clivedon Avenue, Perry Barr, lately trading at 261, High Street, Smethwick.—Trustee, Mr. R. K. Clark, 159, Great Charles Street, Birmingham, Official Receiver, released December 9th.

H. L. A. Wines, radio engineer, King Street, Yeovil.—Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, Official Receiver, released December 15th.

C. Street (Fylde Crystal Lamp Co.), electric lamp distributor, 164, Preston Old Road, Blackpool, formerly trading at 55, Coronation Street, Blackpool.—Application for discharge to be heard on February 2nd at the Court House, Blackpool.

O. G. Lamb, electrician, 26, St. George's Road, Great Yarmouth.—Public examination January 2nd at the Town Hall, Great Yarmouth.

A. T. Burden, electrical engineer, "Meth-Lac" Works, Upper Devizes Road, Salisbury.—Public examination January 5th at the Guildhall, Salisbury.

W. G. Holt, electrical contractor, 7, Shalford Road, South Yardley, Birmingham.—First and final dividend of 10¼d. in the £, payable at 37, Temple Street, Birmingham.

A. L. Drake, electrical contractor, 185, Morley Street, Bradford.—First and final dividend of 11¾d. in the £, payable at 71, Manningham Lane, Bradford.

Electricity Supplies During the Cold Spell

THE recent cold spell was responsible for an extraordinarily high consumption of electricity in London and throughout the country, and although it considerably exceeded normal anticipations the demand was met by the electricity supply industry without difficulty. Even if the mild weather experienced at the beginning of the month had continued there would have been an increase in the demand over the peak of last year owing to the normal development which has been taking place in the industry. As a result of the exceptionally cold weather, however, the demand for electricity throughout the country rose within a week by more than 15 per cent. On December 13th the total load on the generating stations associated with the grid system was about 5,815,000 kW, and on December 20th it rose to about 6,714,000 kW, the highest ever reached in the history of the country.

In ordinary circumstances the peak demand for electricity occurs late in the afternoon of a mid-December day when the period of daylight is short and when, at the height of the pre-Christmas activities, homes, offices, shops and factories are simultaneously requiring the maximum of light, heat and power. In order to meet the anticipated higher peak this year some 760,000 kW of new plant ordered in previous years was brought into service in the selected stations during the past twelve months. Within the same period the demand on the grid stations rose by 748,000 kW from last year's peak of 5,966,000 kW, or 12.5 per cent.

The rise in the temperature on December 21st was reflected in a slight falling off from the peak position for the whole country reached on December 20th, but in London and S.E. England the growth in the demand continued for three days and only began to decline on December 22nd with the further fall in the barometer. In this area the amount of electricity sent out from the stations rose from about 1,740,000 kW on December 14th to about 2,220,000 kW on December 19th, followed by a rise to about 2,260,000 kW on December 20th and a further rise to about 2,285,000 kW on December 21st. The increase in seven days was therefore over 30 per cent.

In meeting these exceptionally heavy calls for energy throughout the country there has been the fullest co-operation between all parties in the supply industry. Practically the entire generating resources of the public supply system were utilised or ready to be brought into service for the occasion. The normal practice at the present time is for the whole of the stations associated with the grid to be interconnected and for the whole system to be operated as one, and this has been the situation during the period of peak conditions.

One of the indications which the sudden rise in electricity demand has revealed is the importance of the electric heating load, since it can reasonably be assumed that the major proportion of the increased requirements arose from consumers switching on additional radiators and heating appliances.

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 21st:—

Xcel (lettering and design). No. 581882. Class 6 (III). Electric vacuum cleaning, washing, wringing and mangling machines, and parts thereof. No. 581883. Class 18 (III). Electric heating and cooking stoves, electric radiators, and electrically heated panels for installations in buildings, air heating plant and electrically heated towel rails.—Elexcel, Ltd., Victor Works, Broad Green, Liverpool.

Radio Interference Free to B.S.S. 800 (lettering and design). No. 582760. Class 6 (III). Electrically operated machinery of all kinds and parts thereof. No. 582761. Class 7 (III). Electrically operated agricultural and horticultural machinery and parts thereof. No. 58276. Class 8 (III). Philosophical and scientific instruments and apparatus for useful purposes. No. 583457. Class 9 (III). Electrically operated musical instruments and parts thereof. No. 582763. Class 10 (III). Electric clocks and parts thereof. No. 582764. Class 11 (III). Instruments, apparatus and contrivances (not medicated) for surgical or curative purposes or in relation to the health of men or animals, all being electrically operated. No. 582765. Class 13 (III). Electrical goods of ordinary metal. No. 582766. Class 18 (III). Engineering, architectural and building contrivances incorporating electrical apparatus. No. 582767. Class 49 (III). Electrical toys. No. 582768. Class 50 (III). Incubators heated by electricity.—British Standards Institution, 28, Victoria Street, Westminster, S.W.1.

Isolector. No. 602559. Class 9 (IV). Metal-clad electric switches and switchgear.—Whitehead Switchgear & Inventions, Ltd., Ferry Road, Cardiff.

Sol-Tan (lettering and design). No. 601117. Class 10 (IV). Electro-medical appliances and apparatus.—London Commercial Electrical Stores, Ltd., 11-13, Farringdon Avenue, E.C.4.

Electrolux (similar lettering in two designs). No. 600065. Class 21 (IV). Suction nozzles for vacuum cleaners, heat-insulated containers for foods or beverages, &c.—Electrolux, Ltd., Oakley Road, Luton.

Electricity Supply

Lighting, Domestic, Power

Blackpool.—ELECTRICITY FOR COUNCIL HOUSES.—The installation of electric lighting at 148 houses on the South Shore estate has been authorised by the Housing Committee.

Burnley.—HIRE-PURCHASE DECISION.—From January 1st the hiring of appliances from the Burnley Gas & Electricity Departments is to be restricted to hire-purchase on a quarterly basis. This decision was reached by a special committee which considered reports of the electrical engineer and gas engineer on the new Hire-Purchase Act. After consideration of a report on the co-ordination of the activities of Gas and Electricity Departments in relation to hire-purchase, it was decided that instalments in the case of both departments should be extended from one to seven years. Consideration of the position concerning the Electricity Department's assisted wiring scheme has been deferred pending a further report.

SODIUM LIGHTING.—The electrical engineer (Mr. J. E. Starkie) has been asked to report on a scheme of sodium street lighting in Todmorden Road, from the Junction with Brunshaw Road to the bus terminus at Towneley Park.

Carlisle.—FIVE YEAR PROGRAMME.—The City Council's estimate of expenditure during the ensuing five years includes £178,243 in connection with its electricity undertaking.

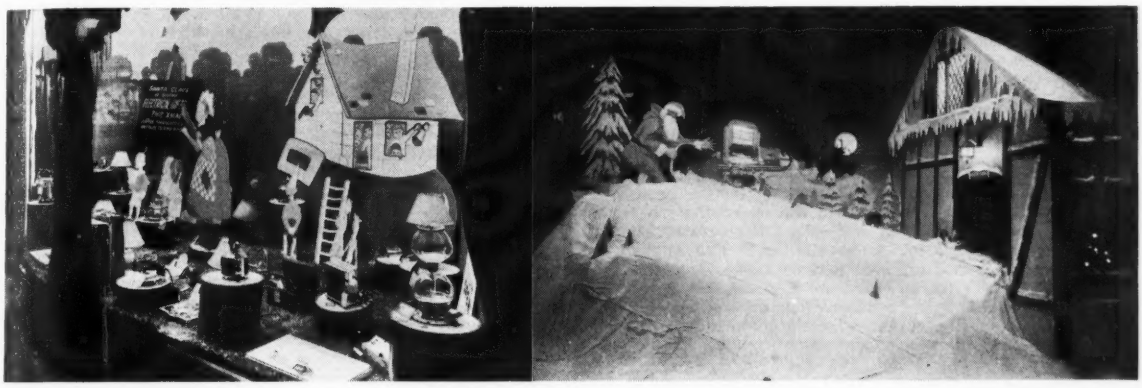
BATTERSEA.—The Electricity Committee is seeking sanction to borrow £2,300 for sub-station equipment.

HACKNEY.—Application is being made by the Electricity Committee for permission to borrow £20,000 for the installation of vertical distributors.

HAMMERSMITH.—The Electricity Committee is to enlarge the Wulfstan Street sub-station at a cost of £417.

Lowestoft.—LIGHTING A BRIDGE.—At an estimated cost of £100 the Corporation is to provide lighting for the swing bridge.

Mexborough.—FURTHER DOMESTIC PROGRESS.—In his report for the past year Mr. E. Andrews, the engineer and manager of the Electricity Department, points out that the increase in output of 11.5 per cent. to nearly 4 million kWh was again due to two-part tariff consumers, most of whom were domestic users. There was an increase in the number of consumers of 205 to a total of 4,291, and it is interesting to note that as far as domestic premises in Mexborough are concerned 97.5 per cent. are now connected to the mains. Per head of the population sales were equivalent to 252 kWh, an increase of 30 kWh during the year, and the average price per kWh sold decreased from 1.87d. to 1.69d. There was an advance of 665 (to a total of 2,284) in the number of appliances on hire during the year, including increases of 318 in boiling rings and 270 in fires. In addition 445 agreements were signed for the hire-purchase of fittings and appliances. To show how the use of such appliances, coupled with the two-part tariff, has influenced sales the engineer states that under the former prepayment system of charging the average kWh sold in 1934-35 to assisted wiring consumers was 92 compared with 346 in 1937-38, while under the Council housing schemes the respective figures were 96 and 424.



Two effective Christmas window displays showing (left) one of the windows of Croydon Electricity Department and (right) a display by the Woking Electric Supply Co., Ltd.

Gateshead.—ELECTRIC STREET LIGHTING.—Subject to a minor modification the Town Council has accepted the terms of the North-Eastern Electric Supply Co., Ltd., for street lighting which will result in a saving of over £70 per annum to the Town Council.

Inverness.—PUBLIC INQUIRY SUGGESTED.—The Electricity Committee has decided to call in an expert to advise the Committee on the desirability of pressing for a public inquiry into the need for more-generating plant at the electricity works, which the Electricity Commissioners have declined to sanction. Mr. G. C. MacLean, burgh electrical engineer and manager, claims that Inverness should be selected as a generating station for any scheme put forward by the Central Electricity Board for the North of Scotland.

Ipswich.—LOAN.—The Electricity Committee is seeking sanction to borrow £63,000 for meters, rental wiring and consumers' apparatus.

SUB-STATION.—A sub-station is to be erected in Bartholomew Street at a cost of £490.

Jarrow-on-Tyne.—BETTER LIGHTING.—Estimates are to be obtained by the Town Council from the North-Eastern Electric Supply Co., Ltd., for the lighting of Leam Lane. Plans are also to be prepared for the extension of the improved electric street lighting system in the centre of the town.

Leeds.—SUPPLIES RESTORED TO DEFAULTERS.—The Corporation issued instructions that no electricity consumers with unpaid accounts were to have their supplies cut off during the Christmas holidays. Those whose supplies had already been discontinued were temporarily reconnected.

London.—BULK SUPPLIES AND PEAK LOADS.—A question of general interest which came before the London and Home Counties Joint Electricity Authority at its quarterly meeting last week related to the use of a proportion of generating plant so as to reduce the cost of the bulk supply by lowering the maximum demand. The Authority's General Purposes Committee reported that the Epsom and Ewell Corporation had formally submitted a proposal that the Corporation's generating plant should be retained in commission to be available to generate electricity either for bulk supply or to reduce the m.d. upon the bulk supply. It suggested that it should be allowed to generate 750 kW (half the capacity of the plant) at peak periods. The proposal was supported at a meeting of representatives of the Borough Councils of Barnes, Finchley, Guildford, Hammersmith, Hornsey, Islington, Kingston-upon-Thames, Reigate and Wimbledon. The Committee authorised negotiations with the Epsom and Ewell Corporation on the point raised.

Milnrow (near Rochdale).—REVISED CHARGES.—The Council recently decided that as from January 1st electricity charges should be revised as follows:—Lighting, 4½d./4d. per kWh, according to consumption; all-in system, fixed charge varying from 20 to 15 per cent. of rateable value, plus ½d. per kWh. Councillor Pickup remarked that the undertaking would have lost £460 in income if the new charges had been applicable during the last twelve months.

Motherwell.—LIGHTING IMPROVEMENTS.—The Lighting Committee has considered schemes for street lighting improvements, and the borough surveyor has been instructed to demonstrate the mercury electric-discharge system. He recommends the laying of additional cables, provision of new lamp standards, &c., at a capital cost of £3,516 in one district and the renewal of existing cable and introduction of high lamp standards, &c., at a capital cost of £1,547 in another part of the town.

Neath.—ELECTRIC DRIVE FOR MACHINE SHOP.—The machine shop at the locomotive and carriage depôt of the Great Western Railway Co. is to be converted from steam engine drive to electric motor drive. In addition, an electrically operated triple ram pump is to replace two steam pumps.

Nelson.—OVERHEAD LINES.—The chairman of the Electricity Committee has announced that the Lancashire County Council and Burnley Rural District Council have withdrawn objections to the supply of electricity to Sabden Fold by overhead lines.

Norwich.—OVERHEAD LINES.—Approval has been given to the erection of overhead lines at Brooke and Langley.

Penrith.—RURAL SUPPLIES.—The Rural District Council is to meet a representative of the Mid-Cumberland Electricity Co., Ltd., to discuss plans for supplying energy to certain parts of the rural area.

Stirling.—CLAIM AGAINST COUNCIL.—A claim for compensation for loss of business during a recent electricity failure in Stirling was placed before Stirling Town Council on December 19th by a local firm of warehousemen. They pointed out that the failure occurred on the very worst day possible for them—a Thursday. At a very conservative estimate, they considered they had lost £110, and they held that the Corporation was

responsible. Judge Wingate asked the town clerk if the Corporation could be held liable in a case of that kind, but the town clerk declined to answer. On the suggestion of the Provost it was agreed that no action should be taken.

Sunderland.—ILLUMINATIONS TO BE CONTINUED.—The Illuminations Committee has reported that this year's illuminations have resulted in a loss of £3,411 and that the credit balance of £1,217 from the two previous years has been converted into a loss of £2,194. A proposal that the Town Council should abandon its annual illuminations display has been rejected.

Swansea.—SUPPLY TO COLLIERY.—The Electricity Committee has arranged terms for affording a supply to the Melyn Colliery, Lonlas, at an estimated cost of £1,335.

AIR RAID PRECAUTIONS.—The Electricity Committee has prepared an air raid precaution scheme at a cost of £5,300.

Tiverton (Devon).—CHANGE FROM GAS TO ELECTRICITY.—The Town Council recently adopted a report of the Health and Lighting Committee recommending that application should be made to the Ministry of Health for sanction for a loan of £1,125 to carry out the conversion of the lighting of the main streets in the borough from gas to electricity. It was pointed out that the change-over would at last give Tiverton up-to-date public lighting.

Tynemouth.—SUB-STATION.—Plans are to be prepared for the building of a sub-station at West Chirton.

EXTENSIONS.—The Town Council has included in its five years' plan £42,600 for extensions in connection with the electricity undertaking.

Wallsend.—SUB-STATION.—The North-Eastern Electric Supply Co., Ltd., is to erect a sub-station in Churchill Street.

CABLES.—The Town Council has approved plans by the North-Eastern Electric Supply Co., Ltd., for electric cables in Lauderdale Avenue, Millfield Avenue, Dinsdale Avenue, Warkworth Avenue, Kitchener Terrace and Sunningdale Avenue.

Watford.—HIRE-PURCHASE FACILITIES.—The general manager recently submitted a report on the necessity for adding to the hire-purchase facilities as a result of the opening of the new showrooms, and it is proposed that an extended system should operate experimentally for three months. The appliances included comprise cookers, breakfast cookers, water heaters, baking ovens, wash boilers, vacuum cleaners, kettles, irons, fires, floor polishers, drying cabinets, hair dryers, food mixers, boiling rings, motor-driven ironers, washing machines, specially designed cooking utensils, dish washers, hot-plates, waffle irons, refrigerators and special lighting fittings.

West Hartlepool.—LOANS.—The Town Council is applying for sanction to borrow £10,000 for mains and services and £2,000 for the change-over of apparatus on consumers' premises.

West Suffolk.—SCHOOL LIGHTING.—At a meeting of the County Education Committee at Bury St. Edmund's recently the School Buildings Sub-Committee reported that it considered that the time had arrived when electricity should be regarded as a normal means of lighting in schools, when available.

Whitby.—OVERHEAD LINES.—The Rural District Council has decided not to oppose plans of the North-Eastern Electric Supply Co., Ltd., for overhead lines at Lealholm.

STREET LIGHTING.—The Council has accepted the estimate of the company for an extension of the street lighting at Hinderwell.

Wigan.—LOANS.—The Town Council is applying for sanction to the borrowing of £7,500 for transformers and switchgear, and £40,000 for mains.

Wimbledon.—FURTHER DOMESTIC DEVELOPMENT.—Under the domestic two-part tariff nearly 32 million kWh was consumed during 1937-38, or 42 per cent. of the total sales, with the high average of 2,830 kWh per consumer. In all there were 36,661 private domestic premises in the area and the average consumption for each works out at 1,425 kWh, a record which Mr. A. E. McKenzie, the chief engineer and manager, justifiably claims is equalled by few undertakings in this country. The number of domestic two-part tariff consumers increased during the year by 2,901 to 11,300. The hiring department enjoyed another successful year, but the sharp falling off in housing development in the area will restrict its activities in future, especially as scope is limited among existing consumers. Thus water heaters are already hired to 42 per cent. of the total domestic premises in the supply area and cookers to 30 per cent. The following are the actual numbers of the principal types of apparatus on hire at March 31st last, with the year's increase in parentheses:—Water heaters, 15,512 (3,027); radiators, 11,374 (1,257); cookers, 11,006 (1,746); irons, 9,257 (1,075); kettles, 9,189 (1,504); and wash boilers, 3,208 (408). Although conditions were unfavourable, the Department's refrigerator hire-purchase campaign achieved gratifying results. In the past three years 171, 272 and 308 respectively have been installed, bringing the total, with 41 previously connected, to 792.

Altogether 76.3 million kWh was sold in 1937-38, an increase of nearly 11 per cent. The number of consumers increased from 39,405 to 41,717. Total revenue was £379,830 (£328,764) and expenditure £359,359 (£293,491), leaving a net profit of £20,471 (£35,273). With regard to expenditure, it is pointed out that the phenomenal increase of 6s. 9d. per ton in the price of coal last year cost the Department £16,341, otherwise the net profit would have been slightly higher than in 1936-37. Reference is also made to the rates paid by the undertaking, the total of £21,019 equalling 8.33 per cent. of the working expenditure on revenue account. The maximum demand was 29,847 kW (26,036 kW). Nearly 57 miles of mains were laid during the year, making the total 1,066 miles. Street lighting improvements carried out included the relighting of four roads by sodium lamps, and the number of electric lamps in commission at March 31st last (4,896) represented a net increase of 445. At the Wimbledon generating station the plant was running on load for 2,033 hours during the year. Energy generated amounted to 16.4 million kWh and the maximum peak load on generated supply was 18,200 kW.

Wood Green.—BETTER LIGHTING.—The Corporation has arranged with the North Metropolitan Electric Power Supply Co. to improve the lighting in Station and Buckingham Roads at a cost of £486.

Traction

Australia.—MELBOURNE TRAMWAYS.—In the report of the Melbourne and Metropolitan Tramways Board for the year ended June 30th last it is shown that the total revenue was £2,218,557 against £2,188,241 in the previous year, but owing to higher working expenses and interest charges the net surplus was lower (£474,842 against £566,335). The Board now controls 125 route miles of electric and 11 route miles of cable tramways. Last summer the chairman of the Board (Mr. H. H. Bell) and the secretary (Mr. R. A. Spencer) visited England to inquire into the latest methods of tramway construction and to investigate all forms of street transport operation.

Blackpool.—SUCCESS OF REORGANISATION.—On April 1st, 1933, with the approval of the Council, the Transport Committee embarked upon a five-year reconstruction scheme, following a comprehensive report submitted on the matter. The object of the scheme was to provide more frequent services, better and safer vehicles and equipment, and to reduce the loss on omnibus operation, which at that time stood at £66,861. In his report for the past year Mr. W. Luff, general manager, shows that during the five years the whole of the £66,861 has been recovered, in addition to a further £7,062, so that on the omnibus section during the five years there has been a credit balance of £73,923 after providing all expenses, including depreciation. This has not been achieved at the expense of the tramway section, because on the tramways during the five years there has been a credit balance of £176,484 after providing all charges, income tax, and interest and sinking fund, as well as providing for losses on mineral sidings and coach and car parks. Altogether the reorganisation of the municipal transport system has resulted during the five years in a credit balance of £250,407. Of this sum £43,000 has been contributed to relief of rates (up to the present the total contributed by the Department to rate aid has been £242,497), and the balance of £207,407 has been expended on works of a capital nature. During the five years the Department has also paid local rates amounting to £71,899, and has paid £17,369 for street improvements. In the reorganisation it was not necessary to dismiss men, nor to reduce wages. In fact, the wages have been substantially increased, in certain cases as much as 11 per cent., and all men now have twelve days' holiday with pay against six days in 1933. Notwithstanding substantial increases in consumables, in the case of petrol and oil of 30 per cent., fares have not been increased, but additional concessions have been provided, and workpeoples' and reduced children's fares have been put into operation. In the past year the average revenue per mile in the case of the trams was 18.17d. and the expenses 11.71d., compared with 18.58d. and 11.92d. in the previous year. For buses the figures were 10.80d. and 7.79d., against 11.01d. and 8.18d.

The Transport Committee recently decided to purchase twelve new "toast rack" type tramcars for use on the Fleetwood-Blackpool route.

Communications

India.—TELEPHONE SERVICES.—Since the creation of a special Telephone Development Fund to finance telephone projects a great impetus is being given to the expansion of services. Beginning with the current year, the estimated cost of telephone works for five years has been put down at Rs. 2½ crores. During the present year Rs. 40 lakhs would be spent out of this amount, and the programme comprises the building of telephone exchanges, the installation of a three-channel carrier system between Bombay-Ahmedabad, Bombay-Karachi and Calcutta-Delhi, and the erection of a second trunk line between Coimbatore and Shoranur. A new automatic exchange is to be installed at Nagpur and there will also be expansion of the Delhi exchange.

Sweden.—INTER-STATE COMMUNICATION.—The increase of telephone communication with Denmark has resulted in the main cable from Scania to Sealand being overloaded. An agreement has been made between the P.O. authorities to share the costs of a new inter-State telephone cable between the cities of Göteborg and Frederikshavn. The link—a submarine cable estimated to cost about £125,000—will primarily serve communication between Sweden and Jutland.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Acton Electric Tools, Ltd.—Private company. Registered December 15th. Nominal capital, £100. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in universal and high-frequency electric tools of all kinds, &c. The directors are: F. H. Walker, Myton House, Myton Road, Barwick (director of Joseph Lucas, Ltd.); A. G. Benstead, California, Ormond Avenue, Hampton-on-Thames (director of Rotax, Ltd.); A. L. Mackillop, 94, Haven Green Court, Ealing, W.5 (secretary of C.A.V. Bosch, Ltd.); and J. W. Houghton, Arlington, Allendale Avenue, Finchley, N.3 (director of Bosch, Ltd.). Registered office: 45, Larden Road, Acton, W.3.

Mountsun Electric Radio, Ltd.—Private company. Registered December 15th. Capital, £100. Objects: To carry on the business of manufacturers of ultra-violet ray apparatus and component parts, electric lamp and valve manufacturers, neon sign manufacturers, electric motor manufacturers, radio and television manufacturers, &c. The subscribers are: W. H. Willcocks, Cliffords Inn, Fleet Street, E.C.4; and S. Mason, 11, Harman Drive, N.W.2. W. H. Willcocks is the first director. Registered office: Cliffords Inn, Fleet Street, E.C.4.

J. P. Products, Ltd.—Private company. Registered December 21st. Capital, £500. Objects: To acquire the business of a manufacturer of electrical appliances and accessories carried on by W. R. Paxton as J. P. Products at rear of 30-32, St. Mary's Row, Moseley, Birmingham. The directors are: S. D. Hinley, 166, Solihull Road, Shirley, Warwickshire; and W. R. Paxton, 111, Station Road, King's Heath, Birmingham. Solicitor: Rowland H. Q. Hayes, 3, Newhill Street, Birmingham.

David Rainbow, Ltd.—Private company. Registered December 21st. Capital, £1,000. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in vacuum cleaners, cash registers, washing and cleaning machines, weighing machines, &c. The subscribers are: J. E. Bold, 105, Foleshill Road, Coventry; and D. Rainbow, "Rosemary," Upper Rosemary Hill, Kenilworth. D. Rainbow is the first director. Registered office: 2, The Quadrant, Coventry.

Slip-Lock Tubelight Fittings, Ltd.—Private company. Registered December 15th. Capital, £500. Objects: To acquire any patents, &c. The permanent directors are: A. J. Clayton, 13, Christchurch Road, S.W.2; and H. C. Chinn, "Round Corner," Ditton Hill, Surrey.

Electro-Colloids, Ltd.—Private company. Registered December 20th. Capital, £10,000. Objects: To carry on the business of mechanical, electrical and chemical engineers, particularly as to the electric treatment of water, &c. The first directors are A. G. Freeborn and W. Turner-Coles. Solicitors: Roche, Son & Neale, 1, Church Court, Old Jewry, E.C.2.

Lighting Factors, Ltd.—Private company. Registered December 17th. Capital, £100. Objects: To carry on the business of electrical engineers and manufacturers and factors, wholesale and retail suppliers of electrical, mechanical, chemical and scientific apparatus, manufacturers, designers and wholesale and retail suppliers of wireless, television sets and gramophones, &c. The subscribers are: W. Oakley, 20, Ashford Road, Tottenham; and D. White, 30, The Greenway, Hendon. Secretary: W. H. B. Oakley.

Returns of Electrical Companies

Statements of Capital

Cunningham Electrical & Radio, Ltd.—Capital, £1,000 in £1 shares. Return dated September 9th, 1938. 800 shares taken up. £800 paid. Mortgages and charges nil.

Erimus Electrical Factors, Ltd.—Capital, £500 in £1 shares. Return dated September 29th, 1938. 375 shares taken up. £375 paid. Mortgages and charges nil.

Dalgetti Electric, Ltd.—Capital, £500 in £1 shares. Return dated October 3rd, 1938. 150 shares taken up. £150 considered as paid. Mortgages and charges nil.

T.M.C.-Harwell (Sales), Ltd.—Capital, £15,000 in £1 shares. Return dated October 6th, 1938. 10,000 shares taken up. £10,000 paid. Mortgages and charges nil.

Electro-Alloys, Ltd.—Capital, £10,000 in £1 shares. Return dated October 6th, 1938. 5,000 shares taken up. £2,000 paid, £3,000 considered as paid. Mortgages and charges nil.

Dean & Noble, Ltd.—Capital, £1,000 in £1 shares. Return dated September 8th, 1938. All shares taken up. £1,000 considered as paid. Mortgages and charges nil.

H. A. Lee, Ltd.—Capital, £1,500 in £1 shares. Return dated September 6th, 1938. 1,425 shares taken up. £625 paid, £800 considered as paid. Mortgages and charges nil.

J. Bramwell & Son, Ltd.—Capital, £300 in £1 shares. Return dated May 6th (filed October 24th). 251 shares taken up. £251 paid. Mortgages and charges nil.

E.M.I. Service, Ltd.—Capital, £100 in £1 shares. Return dated October 12th. All shares taken up. £100 paid. Mortgages and charges nil.

Miller Bros. (Doncaster), Ltd.—Capital, £500 in £1 shares. Return dated October 12th. All shares taken up. £500 paid. Mortgages and charges nil.

Seabrook Batteries, Ltd.—Capital, £100 in £1 shares. Return dated July 30th (filed November 21st, 1938.) All shares taken up. £100 paid. Mortgages and charges, nil.

Borth and Ynyslas Electric Supply Co., Ltd.—Capital, £7,000 in £1 shares. Return dated September 15th, 1938. 4,280 shares taken up. £4,280 paid. Mortgages and charges, £2,500.

Pearce Signs, Ltd.—Capital, £10,000 in £1 shares. Return dated October 6th, 1938. 2,700 shares taken up. £2 paid. £2,698 considered as paid. Mortgages and charges, nil.

Electric Driers, Ltd.—Capital, £2,000 in 2,000 shares of £1 each. Return dated October 13th, 1938. All shares taken up. £1,950 paid. £50 considered as paid. Mortgages and charges, nil.

Increases of Capital

Bradby's Engineering Works, Ltd.—The nominal capital has been increased by the addition of £3,000 in £1 ordinary shares beyond the registered capital of £200.

Fredk. Pollard & Co., Ltd.—The nominal capital has been increased by the addition of £20,000 beyond the registered capital of £40,000. The additional capital is divided into 20,000 6 per cent. cumulative preference shares of £1.

Mortgages and Charges

E. & E. Kaye, Ltd.—Debenture, charged on freehold and leasehold properties at Ponders End, and the company's undertaking and other property, present and future, including uncalled capital (but excluding freehold property known as "The Cedars," Mill Ridge, Edgware), dated December 6th, to secure £50,000. Holders: Prudential Assurance Co., Ltd.

Lancashire Cables, Ltd.—Deposit on November 18th, 1938, of deeds of land and factory in Bewsey Road, Warrington, to secure all moneys due or to become due from the company to Barclays Bank Ltd.

E. Dawson (Lamp Factors), Ltd.—Particulars filed of debentures not exceeding £10,000, authorised December 1st, 1938, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £10,000.

Domestic Electric Rentals, Ltd. (formerly Electric Rentals. Ltd.).—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 10th, 1938, to secure £5,000. Holders: Control Nominees, Ltd.

Electrical Finance and Securities Co., Ltd.—Satisfaction to the extent of £5,656 on October 31st, 1938, of trust deeds dated July 29th, 1927, July 6th, 1928, April 24th, 1930, and January 29th, 1932, and registered July 29th, 1927, July 10th, 1928, April 29th, 1930, and February 1st, 1932, respectively.

Burdette & Co., Ltd.—Satisfaction on November 22nd, 1938, of debenture and charge, both registered June 23rd, 1927, securing all moneys due or to become due from the company to Barclays Bank Ltd.

Anderson & Geary, Ltd.—Satisfaction to the extent of £50 on November 28th, 1938, of debenture dated July 20th, 1938, and registered August 8th, 1938.

Receiver Appointed

H. Etherington & Sons (York), Ltd.—C. L. Etherington, of Derwent House, Newton-on-Derwent, York, was appointed receiver on December 8th, 1938, under powers contained in instrument dated December 21st, 1934.

Reports and Dividends

Baird Television, Ltd., reports that for the year ended June 30th last laboratory, experimental, production, research, publicity, production and sales expenses, etc., less sales of television apparatus, amounted to £71,528, as compared with £80,914 in the preceding year. After providing for general expenses, etc., and crediting transfer fees, the debit balance of £103,274 (£111,903) was transferred to general development account, bringing it to £663,776. The report states that new freehold premises acquired by the company were occupied early in the year, and research work is being carried on in a very satisfactory manner. Within the period of the accounts the commercial progress of television had not developed to any great extent but present signs are that interest is now developing. Accordingly, the board is now considering a definite scheme for raising additional finance which it proposes to place before the shareholders at an early date. It was the desire of the board that the general meeting should be followed immediately by any special meetings which might be required in connection with the proposals for raising new capital. As this will not be possible before the end of the calendar year, in order to comply with the Companies Act, 1929, a formal meeting was to be held yesterday (Thursday) at which the chairman was immediately to propose a resolution to the effect that the meeting be adjourned until a later date of which notice will be given to the shareholders during January.

Marconi's Wireless Telegraph Co., Ltd., is paying a final dividend of 3½ per cent. on the 7 per cent. cumulative participating preference shares.

The Adelaide Electric Supply Co., Ltd., reports a gross revenue of £986,618 for the year ended August 31st, as compared with £964,493 in the preceding year. The net revenue was £27,851 lower at £455,102, the net profit being £365,592, as compared with £382,953. After maintaining the dividend on the ordinary stock at 10 per cent. £118,900 (£107,026) is placed to reserve, leaving £146,027 (£146,835) to be carried forward. During the year the number of consumers connected increased

from 94,798 to 98,263, while the energy sold rose by 10.8 per cent.

Vactric, Ltd., reports a gross profit of £21,750 for the year ended September 30th, as against £39,200 (including £730 from reserve for liability under service guarantees) for 1936-37. After providing for directors' fees £1,350, written off plant £3,326, income tax and N.D.C. £8,298 (£10,755) there remains £8,775. Preference dividends take £3,979, the interim (4 per cent.) on the ordinary shares £4,350 (there was no final dividend), and redeemable preference cumulative sinking fund account £3,372, leaving £429 (£3,354) to be carried forward. The auditors state that "value of the company's interests in Apex-Vactrics, Ltd., is substantially less than the sum of £74,609" shown in the balance sheet. Meeting: To-day (Friday).

Scophony, Ltd., in its report for the year to March 31st states that during the period it has continued technical development of its inventions and £38,485 (against £35,365) has been spent under this heading, a sum of £3,196 has been advanced to the subsidiary Scophony Electronics, for development, making £4,832. During the year the issued capital was increased to £210,000 by the issue of 140,000 5s. ordinary shares at 7s. 3d. per share. Patents, development expenditure, including goodwill, stand in the balance sheet at £197,729. Meeting: To-day (Friday).

The Buenos Aires Town & Docks Tramways, Ltd., reports net receipts amounting to £21,098 for the year ended June 30th last, as compared with £18,156 for 1936-37. The dividend is maintained at 3 per cent. and £999 (£1,543) is carried forward. The company is to continue working as a separate unit until the Transport Corporation has been definitely established and is in a position to take over the company's undertakings and assets, together with those of other transport companies. Meeting: December 29th.

The Melbourne & Metropolitan Tramways Board reports a trading profit of £474,842 for the year ended June 30th last, as compared with £566,335 in the previous year, and a net deficit of £68,024, against a surplus of £1,096. A debit of £65,518 carried forward compares with a credit of £2,506.

W. N. Froy & Sons, Ltd.—Shareholders have rejected a proposal authorising the directors to acquire another similar business.

The Montreal Light, Heat & Power Consolidated has announced a quarterly dividend of 38 cents on the common shares (same), making $1.50 for 1938 (unchanged).

The Shawinigan Water & Power Co. has announced a quarterly dividend of 23 cents on the common shares (against 20 cents and an extra dividend of 5 cents a year ago).

Stocks and Shares

TUESDAY EVENING.

THE review of the Stock Exchange year 1938 makes none too pleasant reading for holders of Stock Exchange securities. It has been, frankly speaking, a bad year. Occasional flashes of animation, which were held at the time to herald the return of confidence, lasted for too short a period for them to be anything but tantalising. The tendency of the investment departments throughout the year has been downward. In spite of the cheapness of money which prevailed from January to December, gilt-edged securities have suffered falls in consequence of the extremely disturbed conditions in Europe.

There was, of course, the crisis at the end of September which forced down prices to levels from which there were in every case sensible recoveries, but the effect has not yet entirely worn off. There is still an uneasy feeling that peace has not been permanently restored to the world. Stock Exchange markets, the hub of the financial world, have acutely felt the effects of uncertainty and suspicion. The failure of international trade to show any disposition to revive is reflected in the falls which have taken place in such stocks as those of Cable and Wireless.

Gilt-edged Under Pressure

Circumstances have conspired to leave gilt-edged prices near the year's lowest points, if the harrowing September days are left out of account. At that period, it will be remembered, the chance of a demoralising slump induced the market to fix minimum prices for dealing in British Government stocks. These events left a legacy of political and financial anxiety which has prevented anything in the character of full recovery. Political worries have been a two-edged weapon, in that they have weakened confidence in the security of British investments, and simultaneously given rise to an urgent need for fresh national expenditure on the defence services. With the virtual certainty of a much inflated armaments bill to be paid for, either by borrowing or taxation, the gilt-edged market can be excused the subdued mien with which it faces the new year. A more cheerful consideration is the Treasury's concern to see the market well supported through the period of borrowing.

The Resistance of Electricity Supply Shares

Legislation for reorganising the electricity supply industry has remained out of sight, but not so far out of mind as to have had no restricting influence on investment in the market concerned. Nevertheless, the market has put up stiffer resistance than most to the uncongenial surroundings. The shares have gained from the retreat of investment from more speculative fields, and from the evidence that the years's fall in industrial activity has failed to suppress the growth of electricity consumption. The table shows that the fall in share prices has been comparatively moderate:—

Ordinary Shares.	December. 1936.	1937.	1938.	Rise or Fall on Year.
Bournemouth and Poole	77/6	67/6	67/6	—
Clyde Valley	45/6	40/–	36/3	–3/9
Elec. Dis. Yorkshire	45/–	41/6	41/3	–/3
Lancs. Light and Power	38/–	33/–	30/9	–2/3
Midland Counties	39/6	37/6	35/–	–2/6
Midland Elec. Power	41/3	41/3	40/–	–1/3
North Eastern	32/6	32/–	30/–	–2/–
Northampton	51/3	45/–	46/3	+1/3
Scottish Power	41/–	37/–	35/–	–2/–
Yorkshire Elec.	44/6	39/6	38/6	–1/–

Of the London supply companies, Metropolitans take the honours with a rise of 3s. 3d., to 48s. 3d. County of Londons are down from 49s. to 44s. 6d., and North Metropolitans from 47s. 6d. to 45s.

Industrial Markets

The course of industrial share prices might be called a seismograph of the year's political disturbances. The sharp breaks registering the more violent shocks have been followed each time by incomplete recoveries. For the second year in succession, therefore, many prices have lost ground to a material extent. In the later months, the signs of trade revival have been a steadying influence and have given substance to the hope of better things to come. It goes without saying that shares with an armaments interest to compensate shortcomings in ordinary business have had the best following. As the table shows, electrical equipment and manufacturing issues have shared the general experience:—

Ordinary Shares.	December 1936.	1937.	1938.	Rise or Fall on Year.
Assoc. Electrical Ind.	52/–	45/–	39/–	–6/–
Babcock and Wilcox	2½	43/3	35/9	–7/6
British Aluminium	44/–	46/3	54/6	+8/3
British Insulated	6¼	4¾	4¼	–10/–
Callender's	4¾	4 7/8	3¾	–⅛
English Electric	29/–	30/–	33/–	+3/–
G.E.C.	94/6	77/–	76/6	–/6
Johnson and Phillips	49/6	41/3	36/3	–5/–
Siemens	35/–	28/9	21/3	–7/6

Of the above companies, British Aluminium, General Electric and Johnson & Phillips made larger distributions than before; while English Electric returned, after a lengthy absence, to the dividend list. On the whole, dividends were well maintained, so that whatever their losses on paper, shareholders have not generally suffered from the point of view of income.

Cable and Wireless

After an early disappointment over the terms of the new agreements between Cable and Wireless and the Empire Governments, prices of the stocks have followed the monthly traffic indices steadily downwards. The company has presented the first accounts since the old "A" and "B" ordinary stocks disappeared under the capital reconstruction of 1937, and has declared a 4 per cent. dividend on the new single stock. A leading event has been the cut in inter-Empire communication changes: but whatever success this may have had in stimulating cable traffic it has not prevented the indices from falling to the lowest figures recorded. The Anglo-American trade agreement provides one consideration to set against the poor showing of the stocks in the following table:—

Stock or Share.	December. 1936.	1937.	1938.	Rise or Fall on Year.
American Tel. and Tel.	187½	146½	158½	+12
Anglo-American pref.	129½	115½	100½	–15
Cable and Wireless pref.	101	102½	77½	–25
Cable and Wireless ord.	—	66	35½	–30½
Great Northern	46½	40	37	– 3
International Tel. and Tel.	12½	7½	10	+ 2½
Marconi Marine	37/6	28/9	23/9	–5/–

Wall Street's energetic response to the mid-year revival of American business is responsible for the cheerful exceptions to the general trend of communication stocks.

Transport Difficulties and Hopes

With a sound chance of better things to come, home railway stockholders will be glad to turn their backs on an unprofitable year. Because, apparently, of the vitality of competition on the roads, the railways' weekly traffic reports have consistently presented worse news than could properly be accounted for by the general state of trade. Fears of a depressing set of reports in February have hardened into assurance. Within a few weeks from now, however, the Minister of Transport will be called upon to give judgment on the claim for freedom, instead of statutory regulation, in the matter of fixing charges. In consequence, the market will open the New Year on a note of subdued optimism. Despite a recovery in the last lap of the year, the average of prices is barely half the opening figure.

Weighty decisions loom also in the London Transport "C" stock's immediate future. The year has been crucial, requiring that the Board should either pay the statutory 5½ per cent. dividend or allow stockholders to apply for a receivership. With a payment of only 4 per cent., the stockholders are now discussing whether they will take steps. Meanwhile, the Board's action in seeking permission to raise fares has restored a better feeling. At 74, the price of the stock ends up with a loss of 6 points.

Electrical Companies' Shares

Prices, dividends and yields

Company.	1938. Highest.	1938. Lowest.	Dividend. Previous.	Dividend. Last.	Price Dec. 23	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies.							
Bournemouth and Poole	68/3	62/–	15	15	67/6	—	4 9 0
British Power & Light	30/9	24/6	6	7	27/6	–6d.	4 18 3
City of London	34/6	28/6	7½	7½	32/–	—	4 13 9
Clyde Valley	42/6	33/–	8	8	36/3	—	4 8 2
County of London	51/9	38/9	10½	10½	44/6	—	4 14 5
Edmundson's:							
7% Pref.	33/3	30/–	7	7	31/3	—	4 9 6
Ord.	40/9	18/9	9	9	25/6	—	—
Elec. Dis. Yorkshire	43/6	37/9	9	9	41/3	—	4 7 5
Elec. Fin. and Securities	51/9	49/–	12½	12½	47/6	—	5 5 3
Elec. Supply Corporation	55/–	50/–	12	12	51/3	—	4 13 5
Isle of Thanet	21/3	18/6	4	4	20/–	—	4 0 0
Lancs Light and Power	35/–	26/–	7½	7½	30/9	—	4 17 7
Llanelly Elec.	23/6	21/–	5½	5½	21/6	—	5 2 4
Lond. Assoc. Electric	32/9	28/–	7	7	30/–	—	4 13 4
London Electric	36/3	32/–	7	7	33/–	—	4 4 10
London Power Deb. Red.	108½	100	5	5	106	—	4 14 6
Metropolitan	51/–	41/–	10	12	48/3	—	4 19 7
Midland Counties	39/9	33/–	8	8	35/–	–9d.	4 11 6
Mid. Elec. Power	41/9	37/–	8	9	40/–	—	4 10 0
Newcastle Elec.	31/9	27/6	7	7	28/9	—	4 17 4
North Eastern Electric:							
Ordinary	34/–	25/–	7	7	30/–	—	4 13 4
7% Pref.	34/–	30/–	7	7	32/–	—	4 7 6
Northampton	47/6	43/9	10	10	46/3	—	4 6 7
Notting Hill 6% Pref. (£10)	14½	13½	6	6	13½	—	4 12 4
North Met. Elec.:							
Ordinary	49/–	43/–	10	10	45/–	—	4 9 0
6% Pref.	30/6	28/3	6	6	29/–	–6d.	4 2 9
Richmond Elec.	30/6	28/–	7	7	28/9	—	4 17 5
Scottish Power	38/9	32/–	8	8	35/–	—	4 11 6
Southern Areas	22/9	18/6	4½	5	21/3	—	4 14 1
South London	32/6	31/–	7	7	31/6	—	4 9 0
West Devon	23/3	21/3	5	5	1½	—	4 9 0
West Glos.	19/–	16/9	2	2	19/6	—	2 1 0
Yorkshire Elec.	42/–	36/9	8	8	38/6	—	4 3 0
Overseas Electricity Companies.							
Atlas Elec.	4/6	2/6	Nil	Nil	2/9	—	—
Calcutta Elec.	44/3	36/3	12*	10*	2	—	5 0 0
Cawnpore Elec.	40/–	35/–	10	10	36/3	—	5 10 6
East African Power	28/3	22/6	7	7	24/–	—	5 16 8
Jerusalem Elec.	26/9	23/3	5	6	24/–	—	5 0 0
Kalgoorlie (10/–)	12/–	9/6	7½	7½	10/3	—	7 6 4
Madras	34/6	28/9	8*	8*	30/–	—	5 6 8
Montreal Power	31¾	26¼	1½	1½	32½	—	—
Palestine Elec. "A"	31/9	27/–	7½*	7½*	30/–	—	5 0 0
Perak Hydro-electric	25/3	17/–	7	6	18/9	—	6 8 1
Shawinigan Power	23½	16½	65cts.	85cts.	21½	—	—
Tokyo Elec. 6%	65½	39	6	6	55½	—	10 16 2
Victoria Falls Power	76/3	55/–	12	13½	68/3	—	3 19 2
Whitehall Investments Pref.	22/3	15/–	7½	7½	17/6	—	8 11 6
Public Boards.							
Central Electricity:							
1950–70	115¾	97	5	5	110½	—	4 10 6
1955–75	118½	100	5	5	113½	—	4 8 1
1951–73	111	95	4½	4½	106½	—	4 4 6
1963–93	101	85	3½	3½	95½	—	3 13 4
London Elec. Trans. Gtd.	93½	88	2½	2½	89½	—	2 15 10
London & Home Counties, 1955–75	112¾	97⅛	4½	4½	110	—	4 1 10
Lond. Passenger Transport:							
A	119½	104¾	4½	4½	110½	—	4 1 5
B	122¾	105	5	5	115½	—	4 6 7
C	84	68	4½	4	74	–½	5 8 1
West Midlands Joint Elec., 1948–68	115½	102½	5	5	113	—	4 8 6
Telegraph and Telephone.							
American Tel. & Tel.	154½	114	9	9	158½	—	5 13 7
Anglo-Am. Tel.:							
Pref.	115½	100½	6	6	100½	—	5 19 5
Def.	28	23	1½	1½	23½	—	6 7 8
Anglo-Portuguese	23/6	19/3	8	8	21/3	—	7 10 7
Cable & Wireless:							
5½% Pref.	104	78	4½	5½	77½	—	7 2 0
Ord.	67½	34	—	4	35½	—	11 4 4
Income	102½	99	—	—	99½	—	4 0 5
Canadian Marconi $1	6/6	3/9	—	Nil	4/9	—	—
Globe Tel. & Tel.:							
Ord.	32/6	26/3	5½*	7½*	25/9	—	5 16 6
Pref.	27/6	23/9	6	6	26/3	—	4 11 5
Great Northern Tel. (£10)	42½	34	20	20	37	—	5 8 1
Inter. Tel. & Tel.	12½	5¾	Nil	Nil	10	—	—
Marconi-Marine	30/6	21/6	10	7½	23/9	—	6 6 4
Oriental Telephone Ord.	59/3	2½	12*	12*	2½	—	4 11 3
Radio Corpn.	9½	4¼	8	6	8	—	—
Telephone Props	13/9	11/3	5	6	13/9	–1 1/16	8 14 6
Telephone Rentals (5/–)	10/–	7/6	5	6	9/3	—	3 4 10
Western Union	34½	17	2½	—	22½	–2	—
Traction and Transport.							
Anglo-Arg. Trams:							
First Pref.	11/–	2/6	Nil	Nil	3/9	—	—
4% Inc.	31	8	Nil	Nil	9	—	—
British Electric Traction:							
Def. Ord.	1060	675	5	5	900	—	—
Pref. Ord.	175	150	8	8	160	–5	5 0 0
Bristol Trams	45/–	34/3	5	8	40/9	–9d.	3 18 6
Brazil Traction	14½	7½	$1	—	9⅛	–⅛	—
Calcutta Trams	26/9	21/6	8	8	24/6	—	6 10 8
Cape Elec. Trams	18/6	15/6	5	6	17/6	—	6 17 2
Lancs Transport	35/3	29/3	10	10	36/3	—	5 10 3
Mexican Light: 1st Bonds	39	16½	5	5	25	—	—
Rio 5% Bonds	91	47	5	5	50	–5	10 0 0
Southern Rly:							
5% Prefd.	87	48	5	—	57	—	—
5% Pref.	116	83	5	5	91½	—	5 9 3
T. Tilling	60/–	36/6	10	10	42/6	—	4 14 1
Tilling & B.A.	57/–	46/–	6	10	50/–	—	4 0 0
West Riding	46/3	30/6	10	10	33/9	—	—
Equipment and Manufacturing.							
Aron Electricity Ord.	40/3	31/–	15	15	1 1/16	—	9 12 0
Assoc. Elec.:							
Ord.	45/3	32/–	10	10	39/–	—	5 2 8
Pref.	38/9	35/6	8	8	36/–	—	4 9 0
Automatic Telephone & El.	43/–	35/–	5	10	41/3	—	4 17 1
Babcock & Wilcox	44/–	32/6	10	10	35/9	—	5 11 8
British Aluminium Ord.	54/–	40/–	10	12½	54/6	—	4 11 9
British Insulated Ord.	95/9	77/–	20	20	4½	—	4 16 10
British Thermostat (5/–)	16/–	9/–	17½	18½	15/9	+3d.	5 17 6
British Vacuum Cleaner	35/9	27/–	5	6	27/–	—	4 9 0
Brush Ord.	5/6	4/9	Nil	Nil	5/–	—	—
Callender's	5½	78/6	20	20	77/6	—	5 3 3
Chloride Elec. Storage	77/9	61/–	15	20	77/6	—	5 3 3
Consolidated Signal	116/–	75/–	30	36½	4½	—	7 13 7
Crabtree (10/–)	29/–	22/–	17½	17½	23/9	—	7 7 4
Crompton Parkinson: Ord. (5/–)	32/3	18/9	12½	15	22/6	–1/–	3 6 8
E. K. Cole (5/–)	8/9	4/6	5	10	6/–	—	8 6 8
Elec. & Musical Industries (10/–)	16/3	9/–	10	5	10/6	–6d.	4 15 3
Electric Construction	36/–	31/–	10	12½	32/6	—	7 13 10
Enfield Cable Ord.	5 5/8	46/–	25	25	2 5/8	—	—
Electrical Switchgear (10/–)	27/–	22/6	16	16	25/9	—	6 4 4
English Electric	33/–	24/6	Nil	10	33/–	—	6 1 3
Ensign Lamps (5/–)	14/3	11/3	—	25	14/3	+3d.	8 15 6
Ericsson Tel. (5/–)	2 1/8	31/–	25*	25*	38/9	—	3 4 6
Ever Ready (5/–)	26/3	16/6	45	35	21/–	—	8 6 8
Falk Stadelmann	34/3	27/–	10	10	27/6	—	7 5 6
Ferranti Pref.	27/6	25/–	7	7	25/–	—	5 12 0
G.E.C.: Pref.	34/–	31/3	6½	6½	31/3	—	4 3 2
Ord.	79/3	67/–	17½	20	76/6	—	5 4 7
Greenwood & Batley	27/6	19/–	7	15	26/3	—	11 8 6
Hall Telephone (10/–)	24/6	18/3	5	15	21/3	—	7 1 2
Henley's (5/–)	21/–	16/–	15	20	19/6	—	5 2 7
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4 0 0
Hopkinsons	40/–	32/6	10	12½	38/9	—	6 8 10
India-Rubber Pref.	21/9	20/3	5½	5½	21/3	—	5 3 6
Intl. Combustion	5/8	4½	30	32½	5⅜	—	6 0 10
Ismay Industries (5/–)	6/9	1/–	6	6	1/3	—	—
J. Lucas	57/9	47/6	15	15	56/3	—	5 6 9
Johnson & Phillips	43/9	32/6	10	12½	36/3	—	6 13 4
Lancashire Dynamo	72/3	58/–	20	25	65/–	—	7 14 0
Laurence Scott (5/–)	12/–	9/–	7	15	12/–	—	6 5 0
London Elec. Wire	35/–	28/3	12	7½	30/–	—	5 0 0
Mather & Platt	49/–	41/3	12	13½	46/3	—	5 17 0
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5 3 6
Murex	93/9	66/3	20	20	78/3	–6d.	5 5 0
Pye Deferred (5/–)	12/–	8/–	5	25	9/6	—	13 3 2
Revo (10/–)	36/3	30/–	12	17½	35/–	—	5 0 0
Reyrolle	62/6	49/–	12½	12½	55/9	—	4 10 0
Siemens Ord.	31/–	20/6	7½	7½	21/3	–1/8	6 13 4
Strand Elec. (5/–)	6/–	4/–	5	10	5/–	—	10 0 0
S. Smith (1/–)	9/9	6/3	37½	50	8/9	—	6 6 0
Switchgear & Cowans (5/–)	19/6	12/6	20	20	15/–	—	6 13 4
Telegraph Condenser (10/–)	18/9	12/–	5	5	12/6	—	4 0 0
Telegraph Construction	2½	36/–	7½	10	2½	—	4 14 1
Telephone Mfg. (5/–)	9/9	7/–	9	9	8/6	–3d.	5 6 0
Tube Investments	89/6	70/–	23¾	23¾	4¼	+¼	5 11 6
Vactric (5/–)	9/9	4/6	10	4	3/9	–9d.	5 6 8
Vickers (10/–)	27/–	17/6	10	10	22/–	—	4 11 0
Westinghouse Brake	63/9	45/–	15	17½	54/–	—	6 9 8
Walsall Conduits (4/–)	26/–	22/6	—	55	25/9	—	8 11 0
West, Allen (5/–)	6/6	4/6	—	7½	6/6	—	5 15 5

* Dividends are paid free of Income Tax.

New Patents

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

9339. "Alternating-current relays." S. Sokal (Elin Akt. Ges. für Electrische Industrie). April 1st, 1937 (Convention date not granted). (496544.)

12113. "Portable electric drills and the like." Desoutter Bros., Ltd., and C. Desoutter. April 28th, 1937. (496483.)

12114. "Portable electric drills and the like." Desoutter Bros., Ltd., and C. Desoutter. April 28th, 1937. (496484.)

12428. "Synchronising signalling systems." W. G. H. Finch. May 11th, 1936. (496485.)

12481. "Electric high-frequency signalling systems." E. C. Cork and J. L. Pawsey. May 1st, 1937. (496647.)

14550. "Systems of electric motor control." British Thomson-Houston Co., Ltd. May 25th, 1936. (496486.)

14788. "Immersion electric heating elements for kettles and other vessels or containers." Eveson Bros. (1928), Ltd., and J. C. Eveson. May 30th, 1938. (496650.)

14842. "Positive plate for a storage battery, and method of making same." D. Nukiyama. May 28th, 1937. (496554.)

14888. "X-ray apparatus." British Thomson-Houston Co., Ltd. May 28th, 1936. (496651.)

14965. "Lighting fittings." British Thomson-Houston Co., Ltd., R. Maxted and E. B. Tuppen. May 29th, 1937. (496390.)

14966. "Lighting fittings." British Thomson-Houston Co., Ltd., R. Maxted and E. B. Tuppen. May 29th, 1937. (496391.)

14978. "Dynamo regulators." C.A.V.-Bosch, Ltd., and W. H. Glaser and N. R. Wood. May 29th, 1937. (496392.)

14979. "Electric motors used for starting internal-combustion engines." C. A. V. Bosch, Ltd., and W. H. Glaser. May 29th, 1937. (496393.)

14996. "Method of making electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. May 29th, 1936. (496555.)

14997. "Electrodes for electron discharge devices." Marconi's Wireless Telegraph Co., Ltd. May 29th, 1936. (496556.)

14998. "Vacuum tubes." Marconi's Wireless Telegraph Co., Ltd. June 1st, 1936. (496557.)

15014. "Method of connecting the windings of the electrical rotating converting machines, known as metadynes." A. Tustin. May 31st, 1937. (496494.)

15016. "Method of controlling the field strengths of series-wound motors." A. Tustin. May 31st, 1937. (496394.)

15074. "Electron multipliers." Fernseh Akt. Ges. May 30th, 1936. (496564.)

15110. "Power driven electric-circuit changing mechanism." British Tabulating Machine Co., Ltd. June 1st, 1936. (496568.)

15118. "Coating with metal of glass tubes or bulbs for use in electric lamps or other purposes." British Thomson-Houston Co., Ltd., W. J. Scott and C. J. Milner. May 31st, 1937. (496716.)

15160. "Electric furnaces." A. E. Watkins. June 1st, 1937. (496497.)

15210. "Electronic attenuators." Baird Television, Ltd., V. A. Jones and T. C. Nuttall. June 1st, 1937. (496398.)

15286. "Manufacture of variable electric condensers." R. Bosch Akt. Ges. June 2nd, 1936. (496653.)

15287. "Variable condensers." R. Bosch Akt. Ges. June 2nd, 1936. (496654.)

15338. "Electric cables." Commercial Secretaries, Ltd., and P. Dunsheath. June 2nd, 1937. (Cognate application 12735/38.) (496400.)

15456. "Luminous screen for cathode-ray oscillographs and methods of making the same." F. Fischer and M. Lattmann. June 4th, 1936. (496662.)

15467. Electric cables employing pulverulent mineral insulation." W. J. Dean, M. Clothier (Legal representative of H. W. Clothier, dec., G. D. Clothier and Pyrotenax, Ltd.). June 3rd, 1937. (496731.)

15538. "Lamps comprising a vitreous envelope surrounding, and structurally integral with, the source of light." General Electric Co., Ltd. (Patent-Treuhand Ges. für Elektrische Glühlampen.) June 4th, 1937. (496404.)

15544. "Electric signalling systems." Standard Telephones & Cables, Ltd., and E. A. H. Bowsher. June 4th, 1937. (Addition to 472431.) (496667.)

15641. "Methods of regulating the characteristics of reactances." British Thomson-Houston Co., Ltd. June 6th, 1936. (Addition to 480067.) (496737.)

15642. "Electric conductors suitable for high-frequency transmission." British Insulated Cables, Ltd., J. L. Packer and H. West. June 5th, 1937. (496672.)

15652. "Electron multiplier amplifier arrangements." Marconi's Wireless Telegraph Co., Ltd., and G. B. Banks. June 5th, 1937. (496674.)

15659. "Automatic arc-welding apparatus." Kjellberg Elektroden & Maschinen Ges. June 6th, 1936. (496675.)

16320. "Control equipment for electric locomotives." F. Whyman and Metropolitan Vickers Electrical Co., Ltd. June 11th, 1937. (496590.)

16975. "Electric contacts." G. Ellison, Ltd., and B. C. Swann. June 18th, 1937. (496593.)

17393. "Automatic electric regulators." T. B. Somerville and Metropolitan-Vickers Electrical Co., Ltd. June 22nd, 1937. (496411.)

17751. "Loud-speakers." Murphy Radio, Ltd., and G. S. Brayshaw. June 25th, 1937. (496504.)

18930. "Remote-controlled switches for alternating currents." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges.) July 7th, 1937. (496415.)

19006. "Tramcars, railway vehicles and the like." Brush Electrical Engineering Co., Ltd., H. W. Hatton and W. Hickman. July 8th, 1937. (496303.)

19432. "Incandescent vapour lamps." W. E. Evans (Standard-Licht-Ges.). July 13th, 1937. (Convention date not granted.) (496304.)

19927. "Electric radiators." S. Hooper. July 19th, 1937. (Addition to 440756.) (496509.)

20158. "Contact members for use in automatic circuit-breakers and other electrical switchgear." J. A. Crabtree and Co., Ltd., H. F. McLoughlin and B. G. Harrison. July 21st, 1937. (Cognate application 13643/38.) (496417.)

21396. "Electrodes for arc welding." United Steel Cos., Ltd., and L. Reeve. August 3rd, 1937. (496511.)

21457. "Electron lenses." O. Klemperer and W. D. Wright. August 4th, 1937. (Addition to 480857.) (496603.)

21707. "Electrical ignition systems for internal-combustion engines." W. R. Debenham. August 6th, 1937. (Cognate application 36089/37.) (496695.)

22005. "Electric discharge vessels." C. Lorenz Akt.-Ges. August 10th, 1936. (496513.)

22308. "Polarised electromagnetic relays." Standard Telephones & Cables, Ltd., R. G. St. Terry and E. A. H. Bowsher. August 13th, 1937. (496697.)

23258. "Wet electrolytic condensers." P. A. Sporing and Telegraph Condenser Co., Ltd. August 25th, 1937. (496605.)

23721. "Electric discharge tubes utilising secondary emission." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 1st, 1936. (496705.)

25109. "Electric indicating systems in or on aircraft. Sperry Gyroscope Co., Inc. September 17th, 1936. (496521.)

26165. "Electric condensers." S. G. Brown and Telegraph Condenser Co., Ltd. September 27th, 1937. (496315.)

27238. "Thermionic valves." M-O Valve Co., Ltd., R. Le Rossignol and S. M. Duke. October 7th, 1937. (496710.)

27626. "Apparatus for ascertaining the quality of illumination of large surfaces, such as roads." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 10th, 1936. (496318.)

27649. "Method of and apparatus for the selective remote-control of operations." Landis & Gyr Akt. Ges. December 24th, 1936. (496422.)

27881. "Fluxes and flux-coated electrodes for electric welding." T. C. R. Shepherd and Metropolitan-Vickers Electrical Co., Ltd. October 13th, 1937. (496711.)

29462. "Cathode-ray oscillator." W. W. Triggs (Farnsworth Television Inc.). October 28th, 1937. (496425.)

29985. "Street-lighting or like fittings." General Electric Co., Ltd., H. A. Moore and A. W. Mainwaring. November 2nd, 1937. (496325.)

30599. "Light-obscuring devices for electric lamps." P. F. Schonberner. November 7th, 1936. (496326.)

32931. "Arc-extinguishing tubes for electric switches of the self-generating gas blast type." British Thomson-Houston Co., Ltd. November 30th, 1936. (496429.)

33072. "Insulating materials." British Thomson-Houston Co., Ltd. December 4th, 1936. (496333.)

34167. "Electric control transformers." British Thomson-Houston Co., Ltd. December 9th, 1936. (496432.)

35600. "Magnetic-dust cores for high-frequency coils." E. Michaelis. December 24th, 1936. (496528.)

1938

738. "Inductance coils." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 13th, 1937. (496617.)

1949. "Loudspeakers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 23rd, 1937. (496619.)

3930. "Electric insulating materials." C. Lorenz Akt. Ges. February 8th, 1937. (496438.)

3972. "Impulse-senders of the type used in telephone systems." General Electric Co., Ltd., and C. C. Puckette. February 9th, 1938. (496347.)

6702. "Electric-lamp holders." British Thomson-Houston Co., Ltd. March 3rd, 1937. (496625.)

7152. "Telephone pay stations." Telephon-Apparat Fabrik E. Zwietusch & Co. Ges. August 17th, 1937. (496356.)

11352. "Electric flat or sadirons." Winstead Hardware Mfg. Co. April 13th, 1937. (496457.)

11475. "Electric current-converting or mutator tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 19th, 1937. (496633.)

11612. "Wireless receiving arrangement with frame antenna." E. Huber. April 16th, 1937. (496634.)

14031. "Safety apparatus for elevators." Waygood-Otis, Ltd. July 2nd, 1937. (496536.)

15761. "Means for cooling electric machines by air-circulation." E. Dick. June 5th, 1937. (496467.)

18052. "Electric carrier signalling systems." Siemens & Halske Akt. Ges. June 18th, 1937. (496540.)

19360. "Apparatus for the electrical precipitation of suspended particles from gases." Lodge Cottrell, Ltd. (Siemens-Lurgi-Cottrell-Elektrofilter Ges., für Forschungs und Patentverwertung). June 29th, 1938. (496639.)

21812. "Time-delays relays." British Thomson-Houston Co., Ltd. July 24th, 1937. (496641.)

23704. "Electric discharge devices." General Electrical Co., Ltd. September 15th, 1937. (496643.)

26059. "Means for forced commutation of current in rectifiers or other static convertors." Allmanna Svenska Elektriska Aktiebolaget. February 27th, 1937. (Divided out of 5579/38.) (496479.)

Contract Information

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Australia.—MELBOURNE.—January 31st. Postmaster-General's Department. Telephone relays. (T. 30041/38.)*
January 23rd. City Council. Supervisory indicating equipment. (T. 29004/38.)*
April 26th. State Electricity Commission. 30,000-kW turbo-generating plant, condensing plant, pipework and accessories. (December 16th.)

Belfast.—January 13th. Electricity Department. Stores and materials for twelve months. (December 16th.)

Birmingham.—January 11th. Salvage and Stables Committee. Fifteen lead-plate batteries for electric refuse collection vehicles. (December 23rd.)

Brighton.—January 4th. Electricity Undertaking. One 5,000-kVA, 33/11-kV outdoor type transformer. (December 16th.)

Cardiff.—January 16th. Electricity Department. Six 1,000-kVA transformers. (See this issue.)

Dublin.—January 18th. Electricity Supply Board. P.i. cables for twelve months. (December 23rd.)

Ebbw Vale.—December 31st. Education Committee. Work on heating apparatus at Duffryn schools, including provision of circulating pump and electric motors. P. Davies, Council Offices (deposit £1 1s.).

Gloucestershire.—Education Committee. Electric lighting in new infants' council school at Kingswood, Bristol. County architect, Shire Hall, Gloucester.

Halifax.—December 31st. A.R.P. Committee. Electrical work in connection with the adaptation of existing buildings at Stoney Royd as storage depot. Town Clerk, Town Hall (deposit £1 1s.).

Hull.—January 17th. Electricity Department. Stores and materials for twelve months. (See this issue.)

India.—NEW DELHI.—January 3rd. Indian Stores Department. One Diesel-engine driven generator with static balancer. (T.Y. 29676/38.)*
January 5th. Indian Stores Department. Underground cable. (T. 30294/38.)*
CALCUTTA.—January 14th. Indian Stores Department. Three Diesel-engine driven generators and complete power-house equipment. (T.Y. 29677/38.)*

Kent.—January 17th. County Council. Internal telephone systems at Chatham County Hospital and the Gravesend, Malling and Sundridge Institutions. Broadcast bells and buzzer systems at Farnborough, Sheppey and Chatham County Hospitals. (December 16th.)

London.—BETHNAL GREEN.—January 30th. Electricity Department. Extra-high-voltage switchgear for one of the Council's sub-stations. (December 16th.)
H.M. OFFICE OF WORKS.—January 6th. Installation of low-voltage, telephone and fire alarm cables at Bridgend, Brackla Hill R.O.F. (December 16th.)
January 20th. Switchgear, transformers, &c., for sub-station at Glascoed R.O.F. (See this issue.)
COMMISSIONERS OF H.M. WORKS AND PUBLIC BUILDINGS.—January 5th. Electric wire and cable. (December 23rd.)
STOKE NEWINGTON.—January 12th. Electricity Department. Extra-high-voltage and low-voltage cables and cable laying, cookers, kettles, wash-boilers, water heaters, cooker control units, conversion to AC of DC radio apparatus, solder, wiring on consumers' premises, house service meters, underground disconnecting boxes, plumbing and fixing water heaters and meter boards for twelve months. (See this issue.)

Liverpool.—January 13th. Electric Supply Department. Materials for twelve months. (See this issue.)

Manchester.—January 18th. Electricity Committee. Domestic electric cookers for twelve months. (See this issue.)

Moray and Nairn.—January 4th. Joint County Council. Central heating and electrical work in connection with new county buildings and offices at Elgin. J. Findlay, county architect, Greyfriars Street, Elgin.

Morecambe and Heysham.—January 9th. Electricity Department. Six 400-kVA transformers. (See this issue.)

Morley.—January 9th. Electricity Department. Cables, meters, joint boxes, service cut-outs, transformers, cookers, kettles, radiators, wash boilers, water heaters, immersion heaters, lamps and street lighting equipment for twelve months. (December 16th.)

Newcastle-on-Tyne.—January 21st. Transport and Electricity Committee. High-voltage, lead-cased, p.i. cable. (December 16th.)
City Council. Installation of electric lighting at the isolation block at the Walkergate City Hospital. Plans by R. G. Roberts, city architect, 18, Cloth Market.

Newport.—Electrical work for new police station and law courts at the Civic Centre. Albion T. Snell & Partners, Suffolk House, Laurence Pountney Hill, Cannon Street, E.C.4.
Electricity Department. 10,000 electric lamps. A. Nichols Moore, electrical engineer, Electric House, Dock Street.

New Zealand.—WELLINGTON.—February 3rd. Posts and Telegraph Department. Twelve 230/25-V step-down transformers. (T. 30045/38.)*
February 3rd. Quantities of telephone cable. (T. 30104/38.)*
February 1st. 300 miles of cable. (T. 29810/38.)*
January 31st. Public Works Department. Quantities of 400-V cable. (T. 30048/38.)*
January 31st. Cable. (T. 30679/1938.)*

Portsmouth.—January 23rd. Electricity Undertaking. High-voltage cables and fire protection equipment for the existing 6.6-kV switch house at Gunwharf Road generating station. (See this issue.)

Royton.—January 9th. U.D.C. Installation of street lighting: Oldham and Rochdale Roads (sodium) and Higginshaw Lane and Heyside (mercury). (December 16th.)

Saltcoats (AYRSHIRE).—December 30th. Town Council. Electrical installations at forty-eight houses. Joint Town Clerks (deposit £1 1s.).

Sheffield.—January 12th. Electricity Department. Pipework, tanks, valves, &c., in connection with a 50,000-kV turbo-alternator. (December 16th.)

South Africa.—PRETORIA.—January 19th. Union Tender and Supplies Board. Inter-office telephone communication system. (T. 30013/38.)*
January 18th. Electric Supply Department. Forty-five 10-kVA, forty-five 20-kVA and ten 50-kVA transformers. (T. 30437/38.)*
JOHANNESBURG.—January 18th. City Council. 260 10-A, 220-V house service electricity meters. (T. 30264/38.)*
PORT ELIZABETH.—January 12th. City Electrical Engineer's Department. Low-voltage cables, tubular steel poles and street-lighting fittings. (T.Y. 30151/38.)*

Stranraer.—January 18th. Town Council. Electrical fittings at 100 houses. Town Clerk (deposit £1).

Torquay.—January 10th. Borough Council. Complete pumping installations comprising four, two and three pumps, together with electric motors and control equipment, pipes, steel floors, crane and all necessary accessories. H. A. Hield, Town Clerk, Town Hall (deposit £5 5s.).

Uruguay.—MONTEVIDEO.—January 11th. State Electricity Supply and Telephones Administration. Various metering instruments and apparatus. (T.Y. 30102/38.)*

Wakefield.—January 2nd. County Council of the West Riding of Yorkshire. Installation of water heating apparatus and electric lighting at Hatfield new senior school and extensions at Mexborough Doncaster Road school. Electric lighting installation at Hatfield Woodhouse school. Clerk of the County Council, County Hall.

West Hartlepool.—January 18th. Electricity Department. Five 300-kVA transformers. (See this issue.)

Wick.—January 9th. Town Council. Electric lighting works at eighty houses. Town Clerk (deposit £2 2s.).

Orders Placed

Bedford.—Electricity Committee. Recommended. Street-lighting control equipment (£4,207).—Automatic Telephone & Electric Co.
Recommended for twelve months. Meters.—Met.-Vick. Electrical Co.; Chamberlain and Hookham; Venner Time Switches. Cooker control units.—W. H. Holland. Meter boards.—Wootton and Co. House service fuses.—Henley's. Cookers.—Jackson Electric Stove Co.; Revo Electric Co. Water heaters.—Johnson and Phillips. Kettles.—Bulpitt & Son.

Birmingham.—Education Committee. Accepted. Electric lighting installations: Paget Road Pype Hayes school (£430), Brookfields school (£126), Birchfield Road school (£318), and Acocks Green school (£143).—H. Pratt. Shrewsbury Industrial school, Warwickshire (£438).—J. H. Payne (Birmingham). Clifton Road school (£150) and College Road school (£149).—W. J. Sheath. Loxton Street school (£103).—Parker, Winder and Achurch.

Glasgow.—Electricity Committee. Accepted. Four 800-kVA transformers (£1,806) and twelve 400-kVA transformers (£3,143).—British Electric Transformer Co. Eight 800-kVA transformers (£3,611) and eighteen 400-kVA transformers (£4,715).—Bruce Peebles & Co.

London. — BATTERSEA. — Electricity Committee. Accepted. Circuit-breakers (£168).—Met.-Vick. Electrical Co. Transformers: One 500-kVA (£284) and two 500-kVA (£585).—British Electric Transformer Co. Transformer kiosk (£486).—G.E.C.

Middlesex.—Health Committee. Recommended. Electric scrubbing machine for Central Hospital (£94).—Simon Electric Co. Two electrically heated food containers for Hillingdon Hospital (£156).—F. Magrini.
Education Committee. Accepted. Electrical installation at Chiswick county school (£1,337).—Read & Partners.

Rawtenstall.—Transport Committee. Accepted in lieu of withdrawn tender. Electric lift at bus garage.—Equipment & Engineering Co.

Shipley.—Electricity Committee. Accepted. Cables for twelve months.—Ismay Cables.

Tynemouth.—Town Council. Accepted. Electrical installations in 214 houses on the Ridges estate (£935).—Bonham Elecl. Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Buildings (including restaurant, shelters, &c.), Bay of Nigg, for the Corporation (£12,500); city architect.

Alnwick.—Houses, Radcliffe; R.D.C. surveyor.

Bedford.—School, Beckett estate; M. J. Slater, architect.

Birmingham.—Houses (40), Gilbertstone Avenue and Trentham Grove; Jack Cotton & Partners. Houses (118), Wolverton Road, Northfield; Excelda Housing Supplies, Ltd. Block of factory and office buildings, Kitts Green, Yardley, for James Booth & Co., Ltd., Nechells; C. Bryant & Son, builders, Whitmore Road, Small Heath. Buildings, Worcester Street, for Loo Bloom, 151, Great Hampton Row. Stores, Gooch Street, for F. W. Woolworth & Co., Ltd., 105, New Street; Staff Building Department.

Blyth.—Additions to fire station, for the T.C.; borough engineer.

Bonnyrigg.—Cinema, High Street; Mrs. G. L. Readshaw, proprietrix.

Bournemouth.—Health centre, Stewart Road (£5,800); borough engineer. Hotel, Broadway, Southbourne; Eldridge Pope and Co., Ltd. Additions to Elderly Nurses' Home, Riverside Avenue; trustees. Alterations to Regent Cinema, Westover Road; Gaumont British Picture Corporation, Ltd.

Carlisle.—Houses (500) during 1939, for the City Council; city architect.

Castleford.—Fire station (£3,700); U.D.C. surveyor.

Chesterfield.—Houses (300), community centre and shops, Birkenstile estate, Stonebroom, for R.D.C.; J. B. Wikeley, R.D.C. surveyor.

Coventry.—Houses (100), Timothy Grove; Youell & Son, builders, Walsgrave Road. Houses (30), Cheveral Avenue; Philpot Bros., builders, 117, Much Park Street. Additions to the works and offices of the Coventry Gauge & Tool Co., Tile Hill, Fletchamstead.

Cranbrook.—Houses (62); R.D.C. surveyor.

Darlington.—Houses (20), Highfield Road; Bussey and Armstrong, builders, Brinkburn Road. Alterations, Upper Archer Street, for Hart and Co.; Dunn and Dunwell, builders, Arden Street.

Derby.—Premises, Sitwell Street, for Progressive Supply Co., Ltd.

Dunfermline.—Ice rink (£40,000); J. Fraser, architect, Dunfermline.

Durham.—Schools, Horden and Willington, for the C.C.; D. Glen, builder, Back Queen's Road, Jarrow-on-Tyne.

Ealing.—Enlargement of technical college (£101,452); Ford & Walton, Ltd., 53, Victoria Street, S.W.1.

Edinburgh.—Physical fitness centre; city architect.

Exeter.—Office buildings, Commercial Road; A. C. Luxton, architect, Bedford Circus.

Fenton (STAFFORDSHIRE).—Houses (14), Grove Road; J. B. Thompson. Houses (16), Pool Street; G. Pennell.

Glasgow.—Houses (150), Dennistoun; architect, Housing Department. Cinema, Anniesland, for the Great Western Cinemas, Ltd.; A. B. King, cinema proprietor, director. Cinema, Great Western Road, Ascot Avenue, for the Great Western Cinemas, Ltd.; C. J. McNair & Elder, architects. Luxury flats, Sauchiehall Street and Rose Street (nine storeys with shops); Robert S. Turnbull & Co. Offices, St. Vincent Street; Yorkshire Insurance Co., Ltd. Extensions to St. Rollox works; I.C.I., Ltd.

Halesowen.—Houses (70), Lyde Green Road, Cradley; J. Bloomer.

Hanley.—Houses (14), Fenton Road; Holloway & Co. Houses (16), Severn Avenue; Salt & Trice.

Haslemere.—Baths (£10,000); U.D.C. surveyor.

Hebburn-on-Tyne.—Offices to the works of Wailes Dove Bitumastic Co.; J. L. Couves and Partners, architects, Carliol House, Newcastle-on-Tyne.

Ilkley.—Buildings for the Board of Management of the Ilkley Coronation Cottage Hospital (secretary, L. Hartley, Ilkley); A. H. Watson, architect, 2, Barstow Square, Wakefield.

Irthlingborough.—Houses (25), Addington Road, for the U.D.C.; W. Thompson & Sons, builders, 38, Finedon Road.

Jarrow-on-Tyne.—Clinic and offices at the Town Hall (£17,500), and gymnasium at Leam Lane school, for the E.C.; borough engineer. Six shops and billiard hall, York Avenue; J. Taylor, builder, 10, Stuart Street, Easington.

Kenton (MIDDLESEX).—School, Kenton; R.C. authorities.

Kidderminster.—Dairy and warehouses, for the Kidderminster Co-operative Society, Ltd.; Walker, Ltd., builders, Castle Road.

Leeds.—Clothing factory, for Jackson & Son, Ltd., Stamford Street; Stephenson & Gillis, architects, Saville Place, Newcastle-on-Tyne.

Liverpool.—Cinema, Church Road, Wavertree (£35,000); A. E. Shennan, architect, 14, North John Street, Liverpool.

London.—(FULHAM).—Tenements, Munster Road; borough engineer. (ST. JOHN'S WOOD).—Houses, Hamilton Terrace and Carlton Hill; Binns & Scarlett, 19, Southampton Street, W.C.1.

Manchester.—Factory, Harper Road, Northenden, for K. V. Hill; Rochford Bros., builders, Ivy Road, Macclesfield.

Middlesbrough.—Houses (26), Merlin Road; C. J. Boyd, builder, 15, Emmerson Street. Houses and shops, Glendale Road; N. Thompson, Ltd., builders, Stone House Street. Cinema, Redcar Trunk Road, for Thompson's Enterprises, Ltd.; Kitching and Co., architects, 21, Albert Road. Additions to St. Mary's College; T. Crawford, architect, 82, Borough Road. Alterations and additions to premises at Gloucester Street, for Neshams, Ltd.; Archibald and Archibald, architects, 25, Albert Road.

Neath.—Premises, Cimla, for Neath & Briton Ferry Co-operative Society; W. R. Berwyn William, architect, 27, Orchard Street.

Newcastle-on-Tyne.—Rebuilding bakery, Pitt Street; Mr. R. Burke, architect, Northumberland Road.

Paignton.—Houses, Central Avenue; Lewis & Wills.

Rawtenstall.—Houses (16), Clayton Avenue; G. Clayton & Sons, Ltd.

Redcar.—Houses (14), Corporation Road; F. Bainbridge. Amusement arcade, Esplanade; Mr. Bestwick.

Saddleworth.—Houses (62), &c., Lido estate, Grotton; Whitehouse and Stubbs, builders, Oldham Road, Grotton.

Sedgley.—Houses (26), near Coton Road; Brookes & Son.

Shipley.—Extensions to works, Hirst Wood Road; Scott Motor Cycle Co.

Stockport.—Houses (154), &c., near Gorton Road, Reddish; Emlyn Jones, 15, Marine Road, Bramhall, Stockport. Houses (32) in blocks, Grassmere Avenue, near Brierfield Road, for Cormack & Co. (Lancashire), Ltd., Broadstone Hall estate, Heaton Chapel. Houses (337) and shops, &c., Thornley Lane, Wilton Street, Davenham Road, Summerford Road, Newhall Road, Belvedere Road and Linfield Road, Reddish; S. & H. Sharples, Ltd., builders, 24, Criterion Street, Reddish.

Stoke-on-Trent.—Houses (14), Riverside Road; H. W. Cartlidge.

Stourbridge.—Rebuilding of the Kings' Hall Cinema; Hickman & Son, builders, Crescent Lane, Brierley Hill.

Swansea.—Houses (384), Bonymaen estate; borough architect. Houses (12), Cherry Grove; A. E. Wright. Offices, etc., Mansel Street; Baptist Union. Rebuilding of factory, Upper Strand; Jones Bros.

Tynemouth.—Houses, King Street; Hastie D. Burton, Ltd., builders, King Street, North Shields. Houses, Preston Colliery, for U. A. Ritson and Sons; Cackett, Burns, Dick and McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne. Community centre, Ridges estate, Council offices (£50,000), and houses, for the T.C., and additions to municipal high school for E.C.; borough engineer. Gymnasium, Linkhill school (£5,617), for the E.C. Flats (20), Verne Road; Jake Burton, builder, North Shields.

Walsall.—Houses (24); Semlo, Ltd., builders, Walsall Road.

Wembley.—Enlargement of Preston Park school (£12,786); McManus & Co., Ltd.

Wokingham.—Council offices (£10,000); R.D.C. surveyor.

Worcestershire.—Schools, Hurcott Road, Cradley, for the Church of England Authorities; Bridgewater Bros., builders, Cradley.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, January 5th. Institution, London, W.C.2. 6 p.m. "The Application of Electric Heating to Domestic Hot-Water Supply Systems," by Mr. J. I. Bernard.

Wireless Section.—Wednesday, January 4th. Institution, London, W.C.2. 6 p.m. "Long Feeders for Transmitting Wide Side-Bands, with reference to the Alexandra Palace Aerial-Feeder System," by Messrs. E. C. Cork and J. L. Pawsey. "E.M.I. Cathode-Ray Television Transmission Tubes," by Dr. J. D. McGee and Dr. Ing. H. G. Lubszynski.

Meter and Instrument Section.—Friday, January 6th. Institution, London, W.C.2. 7 p.m. "Instruments incorporating Thermionic Valves, and their Characteristics," by Messrs. E. G. James, G. R. Polgreen and G. W. Warren.

North Midland Centre.—Tuesday, January 3rd. Hotel Metropole, King Street, Leeds. 7 p.m. "Recent Progress in Power Rectifiers and their Application," by Mr. W. G. Thompson.

North-Western Centre.—Tuesday, January 3rd. Engineers' Club, 17, Albert Square, Manchester. 7.15 p.m. "The Application of Electric Heating to Domestic Hot-Water Supply Systems," by Mr. J. I. Bernard.

Tees-Side Sub-Centre.—Wednesday, January 4th. Cleveland Technical Institute, Middlesborough. 6.45 p.m. "Electric Heating for Merchant Ships," by Mr. H. C. MacEwan.

Physical Society.—Tuesday, Wednesday and Thursday, January 3rd, 4th and 5th. Imperial College of Science and Technology, London, S.W.7. Annual exhibition of scientific instruments and apparatus.

Institute of Fuel.—Wednesday, January 4th. Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1. 7 p.m. Joint meeting with the Institution of Heating and Ventilating Engineers. "Heating Sources for Installations requiring 20,000,000 British Thermal Units per Hour and Over," by Messrs. J. H. Macintyre and A. Grant.

Association of Supervising Electrical Engineers.—Thursday, January 5th. Aldwych House, London, W.C.2. Informal meeting. 7 p.m. "Factories Act, 1937," by Messrs. F. R. Bennett and F. Murgatroyd.

Association of Mining Electrical Engineers *(West Wales Branch).*—Saturday, January 7th. "Faults on Plant in Service," by Mr. T. J. Howells.

North-Western Branch.—Saturday, January 7th. Engineers' Club, Manchester. Annual dinner.

South Wales Branch.—Saturday, January 7th. "Electrical Testing under the Coal Mines' Act," by Mr. F. C. Knowles.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

KENTON switch.

COMPANY MEETING.

EDMUNDSON'S ELECTRICITY CORPORATION, LIMITED.

Notable Achievements of Co-ordinated Control.

Remarkable Expansion of Business.

Sir Thomas Royden's Review.

THE 41st Ordinary General Meeting of Edmundson's Electricity Corporation, Ltd., was held at Thames House, Millbank, London, S.W.1, on Thursday, 23rd June, 1938.

Sir Thomas Royden, Bart., C.H. (chairman of the Company), presided.

The Secretary (Mr. C. H. Jones, F.C.I.S.) having read the notice convening the Meeting and the Auditors' report,

The Chairman said: Ladies and Gentlemen,—

The Report of the Directors and Statement of Accounts have been in your hands for some days. Is it your pleasure that they be taken as read? (Agreed.)

Mr. R. P. Sloan, who was formerly a Director of this Corporation, has rejoined the Board during the past year. His wide experience of the electrical business, and his comprehensive knowledge of its requirements combine to render him a very valuable acquisition to the Company.

In accordance with the Articles, the election of Mr. Sloan requires your confirmation, and a resolution to this effect will be submitted to you later on in the proceedings.

The year under review has produced results of exceptional importance to this Corporation. To enable you to view the situation in proper perspective over a period of time I will revert for a moment to the year 1933, when the Executive Management then in control of this highly complex business adopted a carefully considered plan for its future development and operation.

Policy of Co-ordinated Control.

It has been mentioned to you on the occasion of two previous Annual Meetings that it was at that time that there was initiated a policy of co-ordinated control of all the Companies in the Edmundson Group. This policy was predicated upon three basic principles, which may be defined as physical integration, comporate simplification, and a fixed objective of commercial achievement and physical growth.

The desirability of physical integration and corporate simplification may be accepted as a truism. Obviously integration is a sound course. So is simplification of corporate structures, which permits of intelligent investment, sound financing, and efficient management.

In the realm of achievement, definite objectives decided upon after careful consideration of all the possibilities give to the Organisation and its personnel a standard of measurement by which it can be determined whether or not the expected and hoped-for progress and growth of the business is being achieved.

The accomplishment of the 1933 programme has presented many complex problems in that it requires that the interests of the consumers served, the monies of the investor, and the Company's interests generally should all have fair and equitable treatment.

The numerous consolidations that have been effected of various Subsidiary and Sub-Subsidiary Companies into larger and more scientifically controlled and operated units has advanced according to plan, and as rapidly and completely as statutory limitations made possible.

Six direct Subsidiary and twenty-six Sub-Subsidiary Companies have been put into liquidation, and when the liquidations now in progress or in immediate contemplation are completed, as they will be within the next year or two, the Sub-Subsidiaries will be entirely eliminated and the Group will consist of Edmundson's as the Parent Company and ten or twelve directly-owned operating subsidiaries only.

It will be recalled that the Report of the Committee on Electricity Distribution issued in 1936, and commonly known as the "McGowan Report," strongly recommended this policy of amalgamation, and in this respect at least it is obvious the policy of your Company has been, and will continue to be, in complete accord with one of the most important recommendations of that carefully considered document.

Commercial and Physical Development.

From what has just been told to you, you will, I hope, agree that reasonable and satisfactory progress has been made in accomplishing the first two basic principles of the Company's development programme. As to the commercial and physical development I think you will also agree, after hearing the following figures, that this, too, has been satisfactory. Our objective in 1933 was to double the business in five years, and though at that time this may have appeared to be more of an ambitious hope than a possibility, the results actually obtained are all the more remarkable, because they have not only attained, but satisfactorily exceeded, the objective which we then set before us.

During the period under review the figures are as follows:—

Number of Consumers has increased from	176,000 to 378,100 or 115%
Number of Units Sold per year has increased from ...	321,027,000 to 735,933,000 or 129%
Load Connected has increased from ...	496,000 kW to 1,060,000 kW or 114%

COMPANY MEETING.—*Continued.*

The overhead and underground mains have increased by 5,200 miles; 1,235 villages and townships, with a population of 425,000, have been connected, and £9,633,000 of additional capital has been expended. During the same period the Company has received gross revenue from the sale of current of £16,305,992; paid in income-tax and local rates £1,945,556, and paid in salaries and wages to its employés (who now number 8,488) the sum of £5,576,328. The distribution in dividends (less income-tax) to Edmundson's Ordinary Shareholders has been £1,169,351.

In view of the above, surely it must be conceded that your company is meeting with a reasonable degree of success its obligations to the public it has the privilege to serve, and we see no reason why during the next five years the Company's business, if left alone, should not again be doubled.

During the past year alone 45,000 new consumers have been added, an increase of 14 per cent.; 165,800 kW of new load connected, an increase of 19 per cent.; an increase in output of 104,350,000 units, or 17 per cent.; in addition to which 80,616,000 units were exported to the Central Electricity Board.

Extensions of Generating Stations.

Under the direction of that Board we are now engaged in the installation of considerable extensions to the generating capacity of the three Selected Stations operated by the Edmundson Group. In the Shropshire Group the Stourport Station is being increased by 90,000 kW, which will give this Station, when completed, a total capacity of 170,000 kW. In the South Wales Company the Upper Boat Station is being increased by 60,000 kW, which, likewise when completed, will give this Station a capacity of 123,000 kW, and in the Hayle Station of the Cornwall Electric Power Company there is to be an increase of 15,000 kW, thereby making the total capacity of this Station 32,500 kW.

Also under direction of the Central Electricity Board an entirely new Selected Station is in the preparatory stages of construction at Little Barford (Bedfordshire), which is in the area of the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Company and which, when completed, will be operated by that Company. The initial capacity of this station is to be 60,000 kW, which will eventually be expanded by another 60,000 kW, giving a total capacity of 120,000 kW.

As a matter of financial convenience, the Little Barford Station is to be constructed and financed by a Company known as "The B.C. & H. Power Station Company, Limited." This Power Station Company has recently been created with a nominal share capital of £100. The cost of the Station will be financed through issues of debentures.

When completed the Station will be leased for 99 years to the B.C. & H. Company for operation by them under a tripartite financial arrangement entered into between the Central Electricity Board, the Power Station Company, and the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co.

It will be seen from the above figures that the Companies within your Group now have under construction 225,000 kW of additional generating capacity, which will bring the total capacity of the Group's Selected Stations to 385,500 kW, considerably more than double their present capacity. The confidence of the Central Electricity Board in the Edmundson Group's ability to construct and operate this large amount of additional generating capacity will be noted with satisfaction.

The Oxford Undertaking.

During the present session of Parliament the Corporation of the City of Oxford promoted a Special Bill to give to the City compulsory powers to purchase the Order and Undertaking formerly belonging to our Oxford Company, but now acquired by, and consolidated with, our Wessex Company.

When our Wessex Bill was promoted last year it was opposed by the City of Oxford, which attempted to prevent absorption of the Company by the Wessex Company. It was also attempted to introduce into the Bill a stipulation preventing the Oxford or Wessex Companies from opposing, except in matters of detail, a Bill to be promoted at a later date by the Corporation of the City of Oxford giving it compulsory powers for the acquisition of the undertaking in question. This Petition against the Wessex Bill was refused by a Committee of the House of Lords.

The questions at issue in the Petition of Oxford against the Wessex Bill were, in the opinion of Company's Counsel, precisely the same as those presented in a somewhat different form in the Oxford City Bill just referred to. For all practical purposes the recent Bill promoted by the City may be regarded as an effort to have a Committee of the House of Lords reverse a former decision of another Committee of the same House.

Wessex opposed the Oxford Bill and was successful in this opposition. The questions of principle involved were of vital importance, not only to this Company, but to other companies within the United Kingdom which are charged with the responsibility of rural distribution and within whose areas of supply there happen to be important urban centres. Had Oxford City been successful in its efforts, and if the precedent thereby established had been followed by many other urban centres which could quite properly have expected to be granted the same privileges of compulsory acquisition, this Company certainly, and probably many other Companies, would have lost such a large proportion of its consumers and load as to have made the continuation of rural development and supply economically impossible.

Oxford City's efforts would, if successful, have been highly anti-social. It is only by a combination of urban and rural

(Continued on Sup. 32.)

COMPANY MEETING.—*Continued.*

supply that electricity can be brought to the homes of people living in sparsely populated districts at a price which they can afford to pay, and it follows as a logical conclusion that any successful effort on the part of Urban Authorities to acquire for themselves the advantages and economies of supplying electricity in highly concentrated centres of population, to the exclusion of the rural area, is highly selfish—to say the least—and entirely disregards the rights to reasonable consideration of people living in sparsely populated rural districts.

DISTURBING UNCERTAINTIES OF PROSPECTIVE LEGISLATION.

During the two years that have passed since the issuance of what is now commonly known as the "McGowan Report" the public in general, and the electrical industry in particular, have been awaiting the introduction by the Government of legislation. This legislation is confronted with what might be described as a psychological blockade, which is caused by an effort to solve an economic problem of vital importance by the application of political considerations. While it would be idle to speculate upon, or attempt to envisage, the form of the Bill might may be introduced next autumn, it is unfortunately true that the uncertainties surrounding the whole situation are daily becoming more acute.

The satisfactory development of the Electric Supply Industry requires the adoption of plans and policies looking well into the future and the expenditure of very large sums of money in carrying them out. It must be obvious that these sums of money cannot be economically or safely provided, and plans and policies cannot be soundly formulated, while the interests concerned—whether they be municipal or company—are hedged about by disturbing uncertainties. The industry as a whole must get on with its job, and if the Government see difficulties in the situation which are such that they desire additional time for consideration, it would be a help if legislation were introduced as soon as practicable under which the present status quo of both municipal and company interests—without prejudice to either—could be maintained for a period of, say, not less than five years. This would enable many of the interests concerned voluntarily to work out by mutually satisfactory agreements many of the problems which are at present in a state of complete uncertainty.

STAFF PENSION SCHEME.

During the past year a Comprehensive Pension Scheme, based upon a scientifically devised insurance plan, has been made available to all of the permanent employés of the Companies within the Group. It is gratifying to report that this scheme appears to have been highly acceptable to the Company's employés of every class, and, though it imposes a considerable charge on the Company's revenue, it is believed by your Directors to be a proper and sound policy.

May I now turn to the Accounts and deal with these in some detail?

BALANCE SHEET.

Taking the Balance Sheet: I should like first to draw your attention to the changes which have taken place on the Assets side.

Concurrently with the policy of amalgamation already referred to, your Directors felt that where Sub-Subsidiaries, by the reason of their geographical position or size, were incapable of their amalgamation with other Associated Companies, such Sub-Subsidiaries should be transferred to and become direct Subsidiaries of Edmundson's. In pursuance of this policy, controlling interests have been acquired in the South Wales Electric Power Company, Stroud Electric Supply Company, Ltd., Cornwall Electric Power Company and the East Anglian Electric Supply Company, Ltd. These acquisitions, together with the normal development of other Companies, are responsible for the increase in "Investments in Associated Companies" from £8,672,000 to £12,221,000. "Debtors and Payments in Advance" have decreased substantially for the same reason. Balances due by Sub-Subsidiary Companies are included in this, and the substantial removal of such Sub-Subsidiary Companies following consolidation or transfer is responsible for the decrease from £178,000 to £85,000.

"Investments at Book Value" has increased from £21,000 to £303,000. This is due to the sale of our shareholding interest in the Ramsgate and District Electric Supply Company, Ltd., to the County of London Company, the purchase consideration having been satisfied by an issue of Ordinary Shares in the County of London Company, which shares are still held by us.

The "Balance of Cash at Bankers and in Hand" is substantially larger at £427,000, which is due in large measure to the recent issue of new Ordinary Shares.

Turning now to the Liabilities side of the Balance Sheet, it will be noted that the Issued Share Capital has been increased since last year. A year ago the Issued Ordinary Capital amounted to £3,740,000. It was considered desirable to increase this figure by the issue of £750,000 of new Stock at a premium of 50 per cent., which issue took place in January of this year. Before doing so, however, it was considered desirable to round off the Capital at £3,750,000, and thus an issue of £10,000 was made on similar terms to the major issue to salaried members of the Staff of Edmundson's and of the Associated Companies. The Directors also decided that all shares in the major issue which were not taken up by the Stockholders entitled thereto should be allocated to the Staff, with the result that there are now nearly 300 salaried officials of the Group who are Stockholders.

An increase in the issued 6 per cent. Preference Capital has also taken place. 117,680 Shares of £1 each, since converted into Stock have been issued in exchange for Preference Shares in the Subsidiary Companies whose liquidations were in progress or were contemplated under the scheme of consolidation, to which I have already referred.

COMPANY MEETING.—*Continued.*

"Amounts owing to Subsidiary Companies" has grown from a comparatively small figure of £64,000 to upwards of £1,500,000. This increase is due to the fact that several of the Subsidiaries, having transferred their undertakings to Associated Companies, found themselves in possession of cash only for which they had no immediate use. These balances were lent to Edmundson's and will, of course, disappear as the liquidations progress. In two other instances sums are due to the Shropshire Company in consequence of the acquisition of the South Wales Electric Power Company, and to the Urban Company in consequence of the transfers of the East Anglian and Cornwall Companies. These balances will diminish as and when the two Companies involved require the money for new capital expenditure on their own undertakings.

The item "Creditors" has also increased, and this is due to the increased turnover in materials both for Revenue and Capital purposes.

It may be observed that the Debenture Stock Redemption Accounts are set out in different form, the amounts of the Stocks actually redeemed now being transferred to Reserve Account.

POSITION OF RESERVE ACCOUNT.

I deal now with the Reserve Account, where the increase from £683,000 of a year ago to £2,567,000 to-day calls for special mention.

It has always been the policy of this Group to strengthen the Reserves of its Subsidiary Companies in every possible way. In pursuance of this policy a large part of the profits of these Subsidiaries is put back into the business for purposes of development and of establishing adequate Depreciation Reserves or creating General Reserves.

In consequence of the liquidations now in progress within the Group, these Reserves, created over a considerable period of time, have been released and passed on to the Holding Company concerned. In two particular instances these Holding Companies were enabled, in turn, to pass the Reserves to Edmundson's. The Urban Company, having sold a large number of its Subsidiaries to the Cornwall Electric Power Company, and having disposed of that Company and the East Anglian Company to Edmundson's, found itself with cash reserves far beyond its immediate or indeed possible requirements and the Board of the Urban Company, therefore, decided to carry through a Capital Reduction Scheme and to distribute accumulated Reserves to the extent of 30s. per Share. These Reserves had accumulated over a number of years and were only in a very small part due to the transfers of Companies or Undertakings effected during 1937.

The Western Company sold its Stroud shareholding to Edmundson's and its remaining Subsidiaries transferred their undertakings to the Wessex Electricity Company. The Western Company itself went into liquidation. The surplus available after repaying the capital was credited to Edmundsons' Reserve.

Other additions to the Reserve included the appropriations from profits at the last Annual General Meeting, the Premium on the recent issue of new Ordinary Shares, a small amount in respect of a Premium on the Preference Shares in exchange for Preference Shares of Subsidiary Companies, referred to earlier, the inclusion of a non-recurring amount in respect of acceleration of treatment of Ordinary Dividends receivable by Edmundson's from Subsidiary Companies and the changed method of dealing with the reserve arising from Debenture Stocks redeemed out of profits.

I wish to emphasise the fact that all transfers of shares within the Group have been made at valuations independently assessed, and Stockholders need have no fear that in bringing to the Reserve so many additions in the course of the last twelve months the Balance Sheet has been stripped of all inner Reserves. There has been no writing up of any of the Assets.

PROFIT AND LOSS ACCOUNT.

The Profit and Loss Account does not call for any very special note. Increased requirements for Income Tax and National Defence Contribution, for Staff Pensions and for increases in Directors' Fees partially offset a considerable increase in Trading Profit. The increase in the Trading Profit is, of course, entirely due to increased turnover.

A slight reduction in "Dividend and Interest Receivable from Subsidiary Companies" is more than accounted for by reduced dividend paid by the Shropshire, Worcestershire and Staffordshire Electric Power Company on its "B" Capital for 1937. The Directors of that Company preferred to reduce the dividend from the previous rate of 6½ per cent. to 5½ per cent. and to strengthen the Depreciation Reserve of the Company, in view of anticipated writings off within the next few years.

"Interest on Temporary Loans" is substantially higher, and this is due to the unusually large sums due by Edmundson's to its Subsidiary Companies during the last few months of the year.

Before passing from the Profit and Loss Account I would point out that no dividends have yet been received or credited in the accounts in respect of the new acquisitions to which I have already referred.

You will observe from the Report that the Balance available for distribution is £355,446 8s. 11d. The Board propose to utilise this in placing £30,000 to Reserve Account, in providing for the balance of the Preference Dividends for the year, absorbing £32,662, and it is recommended that a final dividend at the rate of 5 per cent. on the Ordinary Stock which participated in the Interim Dividend should be paid. This sum will involve a distribution of £187,000 and makes the total distribution for the year 9 per cent. In addition, the new Ordinary Shares issued at the beginning of January are entitled to a dividend at the rate of 2⅝th pence per Share for

COMPANY MEETING.—*Continued.*

the period to 31st March, and this distribution requires £7,600. If these proposals meet with your approval there will remain to be carried forward to the next account £98,184.

CAPITALISATION OF RESERVES.

In the Report it has been stated that the Directors recommend that there should be capitalised £2,250,000 out of the existing Reserves, by distributing new Ordinary Stock credited as fully paid, in the proportion of £1 of new Stock for every £2 nominal of Ordinary Stock now held. Resolutions to approve of this recommendation will be submitted to you to-day.

Before that is done, however, it will be necessary to increase the capital of the Company to take care of this issue, and a proposal that 3,000,000 new Ordinary Shares of £1 each be created will first be submitted to you. Finally, the distribution of £2,250,000 from Reserves has first to be issued in the shape of Ordinary Shares of £1 each, but in this instance, as soon as allotted, they will be credited as fully paid up and thereafter they can be converted into Ordinary Stock. The formal resolution to permit of this being done will also be submitted to the Meeting.

The Ordinary Capital as it will be after these changes are approved will much more nearly represent the true equity Capital, though it will in no way affect the earning power of the Corporation. It may be noted that had this proposed Capital increase been made a year ago a distribution of 6 per cent. for the year now closed would have meant the same actual cash distribution as the 9 per cent. now being paid.

TRIBUTE TO STAFF.

The past year has been one of exceptional activity. In addition to the continuous expansion of our business there have been numerous amalgamations of the small Companies in our Group, to which I have alluded earlier in my speech, and the preparation of our case against the Oxford City's Bill, the object of which was arbitrarily to deprive us of our rights and interest in the Oxford Company. The work necessitated by these developments has been heavy and has placed a severe strain on the Staff, and more particularly on the Secretary's and Accountant's Departments. It gives me great pleasure to pay a sincere tribute to our Managing Director, General Wade Hayes, and to every member of our organisation, for their ungrudging and whole-hearted response to the constant and very heavy calls made on their time and energies. They have given of their best, and I know that I am expressing what all of us Stockholders feel when I say that we are indeed grateful for, and sincerely appreciate, their loyal and efficient service.

I now beg formally to move:—"That the directors' report and statement of accounts for the year ended 31st March, 1938, be and are hereby adopted and that the dividends recommended for payment be and are hereby declared."

Mr. F. H. James (vice-chairman) seconded the resolution, and it was carried unanimously.

Mr. E. P. Sloan, C.B.E., M.I.E.E., who had been reappointed a director during the year, and the Rt. Hon. Lord Meston, K.C.S.I., and Mr. A. Winterbottom, who retired by rotation, were re-elected.

Messrs. George A. Touche & Co. were appointed auditors.

Resolutions for the increase of capital and the capitalisation of reserves were approved.

The proceedings terminated with a hearty vote of thanks to the chairman, directors and staff. 1540

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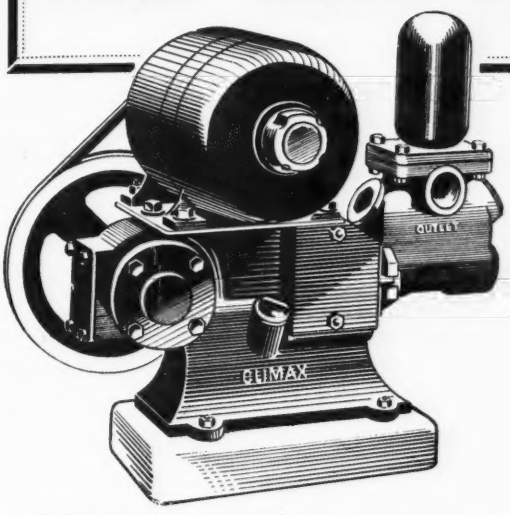

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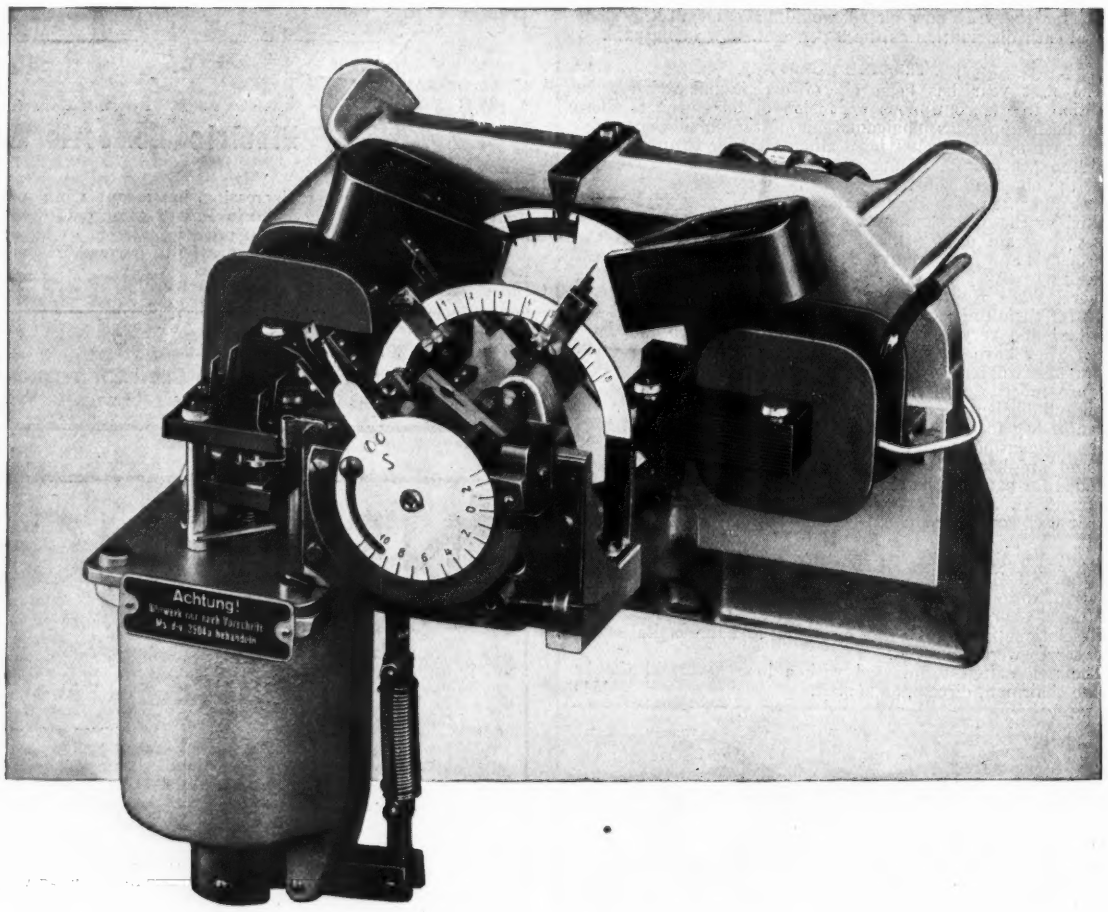

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COMPANY MEETINGS.

PALESTINE ELECTRIC CORPORATION.

Increase in Sales and Profits.

THE 15th ordinary general meeting of the Palestine Electric Corporation, Ltd., was held on Tuesday, 19th July, at the Company's offices, 2, Grosvenor Gardens, S.W.

The Rt. Hon. Viscount Samuel, P.C. (the Chairman) said: The year under review has been one of steady development, notwithstanding the continued unrest in Palestine and the accompanying economic depression. The number of consumers increased in comparison with the previous year by 14 per cent. and the number of units sold by 8.8 per cent. The increase in gross revenue was 4.9 per cent. from £582,765 in 1936 to £611,051. That the increase in revenue is less than the increase in sales is due mainly to the further reductions in our rates which came into effect in the course of the year. It is of interest to note that in the last six years the average charges per unit for all classes of electricity supply to the public of Palestine have been reduced by nearly one-half.

During the year an issue was made of Four-and-a-Half Per Cent. £1 second Redeemable Cumulative Preference shares, ranking junior to the previous issue of preference shares to an amount of £500,000.

NEW POWER HOUSE.

We expended during the year an amount of £668,618 on capital account. The principal items were £341,677 in respect of the new power house near Tel-Aviv, £158,142 on the extension of the Haifa power house and cooling water basin, and £121,097 on transmission and distribution lines and on meters. Notwithstanding the serious delays encountered in delivery of plant and machinery owing to pressure of Government orders in Great Britain, rapid progress was made with the construction of the new power house near Tel-Aviv, and also with the extension of the Haifa power house plant. The new power house has now been completed, and it is expected that it will be put into commission shortly. There are in this room a few photographs which will give you a clearer conception of the work carried out than any verbal description.

The financial plan of the Jordan Concession requires that from 1937 an annual sum should be set aside under the head of capital amortisation fund. Accordingly, that new item now appears in our balance sheet, the amount being £9,754, which is the computed sum needed by the provisions of Clause 1 of the financial plan. An amount of £95,150 has been allotted to reserve for depreciation in respect of the year 1937, and this reserve now stands at £455,391.

Turning now to profit and loss account, the operating expenditure, together with provision for depreciation in 1937, was £343,982, as compared with £326,063 in 1936. This is an increase of £17,919, or 5½ per cent. in comparison with the previous year, but this includes an increase of £9,290 in the allocation to depreciation reserve. The net profit for the year was £235,566. To this we have to add the carry forward from last year of £24,240, making a total of £259,806 available for distribution. Deducting the dividend on preference and second preference shares, and the interim dividend of 2½ per cent., free of U.K. income-tax on ordinary and "A" ordinary shares already paid, which together absorb £77,074, we have a balance of £182,732. We now recommend the transfer to general reserve of £50,000, bringing it up to £250,000, and of £20,000 to the reserve for income-tax and contingencies. We further recommend the payment of a final dividend of 5 per cent. free of U.K. income-tax on the Ordinary and "A" Ordinary shares issued, making a total of 7½ per cent. free of U.K. income-tax for the year, the same as last year, which will absorb an amount of £86,881, leaving a balance of £25,851 to be carried forward to next year.

THE CURRENT YEAR.

You will be glad to be informed that the first six months of the present year again show an increase on the previous year in sales and in gross revenue, although the rate of increase is less. The directors desire again to pay tribute to the managing director and to the staff in Palestine for their efficient and successful work during a trying year, carried on under conditions always of anxiety and often of danger. Thanks to them the operations of the corporation and its revenues have not only been maintained but even show a further expansion in the year under review—a result that is remarkable in the circumstances of the time.

The present state of Palestine must needs be a matter of grave concern to all who care for the welfare of that country and of its people. You will not expect me on the present occasion to enter into political matters. I would only express the feeling which I am sure is uppermost in the minds of you all, of deep regret that Palestine should be the scene of troubles so serious and so prolonged, and of earnest hope that wise statesmanship among the governors and self-restraint among the population may find the way to happier times.

The report was adopted. 1808

ARON ELECTRICITY METER

Record Turnover at London Factory.

Factors Affecting Profits

MR. HARRY KAHN'S SPEECH.

THE 42nd ordinary general meeting of Aron Electricity Meter, Ltd., was held on Monday, 18th July, at Winchester House, Old Broad Street, London, E.C., Mr. Harry Kahn (chairman of the company) presiding.

The secretary (Mr. H. G. Burrows, F.C.I.S.), having read the notice convening the meeting and the report of the auditors.

The Chairman said: Gentlemen,—You have already had the report and accounts in your hands for some time, and I therefore presume that my suggestion that they should be taken as read will meet with your approval.

I regret to say that, owing to his recent illness, Colonel Crompton cannot be present with us to-day. Mr. P. Ashley Cooper is also unable to attend, owing to the fact that he is in South Africa on Government business, as a member of the Rhodesian Royal Commission.

The turnover of the London factory has been a record one, but trading profits have not been commensurate with the increased volume of business. This is due to various causes. Higher costs of production owing to increased wages, the dislocation caused by the building and plant extensions, and also the additional expense incurred by the requirements of the Electricity Supply (Meters) Act, 1936. On the other hand, the selling price of meters has been increased, but, owing to contracts already accepted, has only been effective during part of the year.

There has been no loss made by the Austrian Company this time; in fact, it has shown, for the first time for years, a small profit, which has been left in the accounts of that Company.

RESULTS OF TAXIMETER COMPANY.

The results of the Taximeter Company have been worse, partly owing to the fact that a considerable amount of money has again been spent on alterations to the taximeters, as required by the police authorities. In addition, competition has been very severe, and the taxi-cab trade in general has been experiencing a lean time.

The profit on trading, as shown in the Profit and Loss Account, viz., £44,243, is, owing to causes already explained, £3,327 less than last year.

Transfer and other Fees are £44 less than last year, and Interest on Investments is only £5—£584 less than last year, owing to the sale of our British Government securities early in the year; there was a profit on the sale, however, of £587, which has been added to General Reserve.

On the other side, Directors' Remuneration is £208 lower. Management, Office and General Charges are up by £200. Legal Charges, Audit Fees, &c., are about the same. A new item—Contribution to Staff Pension Scheme, £749, appears for the first time. This represents the Company's contribution to the Pensions Scheme referred to by me in my last year's address. Expenditure on Patents is £104 up.

Another new item is Interest, &c., £870, which practically all arises from our having decided to obtain a loan from our Bankers to meet the cost of the new factory, installation of the same, and additional machinery.

The next item—Provision for National Defence Contribution, £2,000, appears for the first time, and reduces the year's profit to that extent. There is carried to the second section of the Profit and Loss Account £32,578—a decrease of £7,662 compared with last year. From this has to be deducted income-tax, £10,516—a reduction of £605.

The net result is that a profit of £22,061 18s. 3d. is carried to the Balance Sheet—a decrease of £3,557 from last year.

BALANCE SHEET ITEMS.

With regard to the Balance Sheet, Leasehold Premises (less amortisation) figures at £57,932 as against £16,047 last year—an increase of £41,885. This, of course, is due to the payment of the balance of the purchase price of the new premises and the cost of alterations and improvements to the same and adjoining buildings. Plant and Machinery at £31,055 is £6,447 higher than last year, and Tools and Jigs, &c., at £17,095 is more by £4,709. Expenses in connection with the extension and reorganisation of the Factory, £2,303 9s. 10d., is a new item. The amounts of these four items have been subjected to the appropriate depreciation.

Interest in Subsidiary Companies, £14,834, is £778 less than last year. Stock of Meters, &c., and Work in Progress at £125,786 is £14,691 more than last year, consequent upon the larger turnover and increase in number of types of meter manufactured. Sundry Debtors (less reserve) at £73,897 is £11,322 higher than last year.

On the other hand, Investments which were £9,537 last year are down to £100 owing to the sale of our gilt-edged investments to provide part of the money required for the new capital extensions. For the same reason cash at £2,724 is also lower by £21,397.

Turning to the other side of the Balance Sheet, there is no change in the issued capital. Reserve Accounts at £58,226 are £587 up owing to the allocation referred to previously. Unclaimed Dividends and Interest show a reduction of £169. Sundry Trade and other Creditors, including provision for Accruing Expenses, at £31,776, show a reduction of £3,089. Bank Overdraft, £47,446, did not appear last year, and I have referred to the reason for this earlier in my speech.

ALLOCATION OF PROFITS.

The balance of the Profit and Loss Account remaining after the payment of the interim dividend of 5 per cent. is £36,142 13s. 3d., and this the directors propose should be dealt with as follows:—

In paying a final dividend of 10 per cent., less tax, on the Ordinary Shares, making with the interim dividend a total of 15 per cent. for the year, £11,015 7s. 2d., and that the balance amounting to £25,127 6s. 1d. should be carried forward. The latter represents an increase of £5,349.

Since we last met the Company has instituted the system of a week's holiday with full pay for all its workpeople, thus forestalling what will most probably become a statutory obligation sooner or later.

At the present date the installation of our new and renovated factories is practically completed, and I think I can safely say that they are up to date in every way, and that our meter-testing apparatus conforms to every requirement under the Electricity Supply (Meters) Act, 1936.

Great credit is due to our General Manager, Mr. Freeman, and the whole of the Staff and Factory, Employees in maintaining an increased output under the sometimes chaotic conditions caused by the shifting of workshops and machinery during the building and installation operations.

During the year the Board unanimously came to the conclusion that, owing to the expansion of the Company's business in latter years, it would be more advantageous if the Managing Director were a fully qualified Electrical Engineer. In order to give effect to this I resigned my post as Managing Director, which I had held since 1923, and Mr. A. N. Rye, M.I.E.E., a former Managing Director of Edmundson's, was elected to the Board and appointed Managing Director. The election as a Director of Mr. Rye will come up for confirmation later on.

CURRENT YEAR'S PROSPECTS.

At the Annual General Meeting it is usually my practice to make some kind of a forecast for the current year, although with some trepidation. This year, however, it is more difficult than ever in view of the unsettled state of the world, both politically and financially. Nevertheless, with our extended facilities for manufacture and our reputation for first-class products, I see no reason why our Company should not, as hitherto, obtain its full share of the meter requirements of the various Electric Lighting concerns and, barring untoward happenings, consequently show equally favourable results for 1938/39. The turnover for the first quarter of the current year is slightly lower than that for the corresponding quarter of last year. Orders received are also lower. This latter, however, can hardly be regarded as a criterion as, owing to the coming into force of the Electricity Supply (Meters) Act, 1936, Electrical Undertakings placed larger orders than usual before the end of our financial year.

The Taximeter Company is still suffering from the unsatisfactory position of the cab trade. The status of the Vienna Company has up to the present not been altered by the annexation of Austria by Germany. In any case the value of this latter interest has during the past years been drastically written down in the books of the Company and is more than covered by the Capital Reserve.

I now formally move: "That the report and accounts be and they are hereby received and adopted, and that the proposals made therein be agreed to," and after this has been seconded I shall be pleased to hear any remarks or answer any questions from the other side of the table.

Mr. Henry Morgan, F.S.A.A., seconded the resolution and it was carried unanimously.

THE DIRECTORATE.

Mr. Morgan then proposed the re-election of the retiring director, Mr. Harry Kahn, and in doing so said that Mr. Kahn was so very well known to everybody connected with the Company that it was unnecessary for him to say very much in proposing his re-election. He had been a director since 1901 and had rendered very great service to the Company both as managing director and chairman.

Mr. A. N. Rye, M.I.E.E. (Managing Director), seconded the resolution and it was unanimously approved.

On the motion of the Chairman, seconded by Mr. Morgan, the election of Mr. A. N. Rye as a director was confirmed.

The auditors, Messrs. Price, Waterhouse & Co., were re-appointed.

At an extraordinary general meeting of the company which followed resolutions were passed adopting new Articles of Association.

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The ELECTRICAL REVIEW

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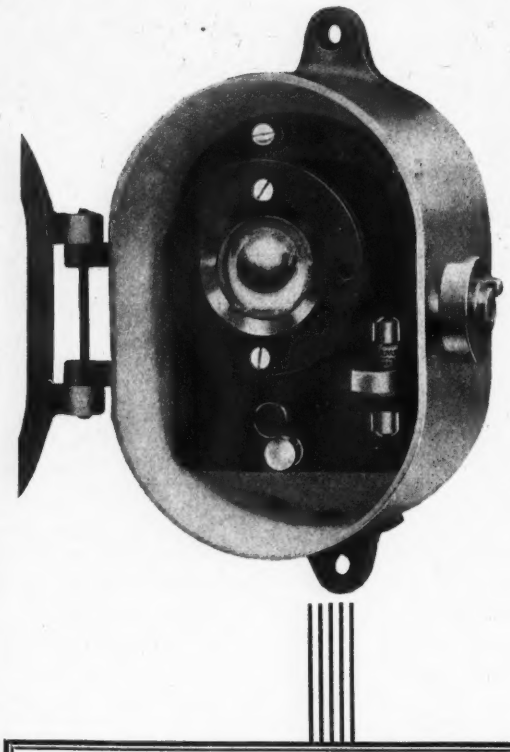

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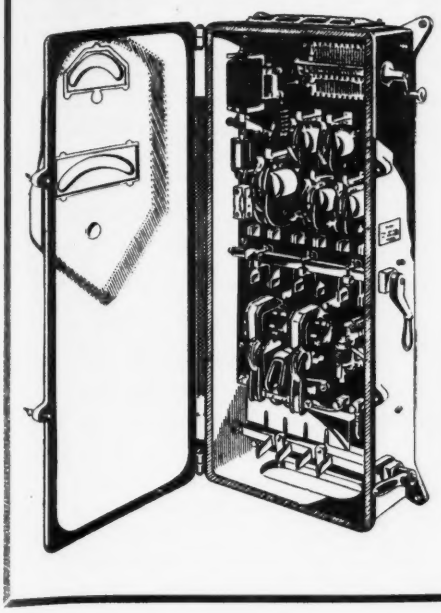

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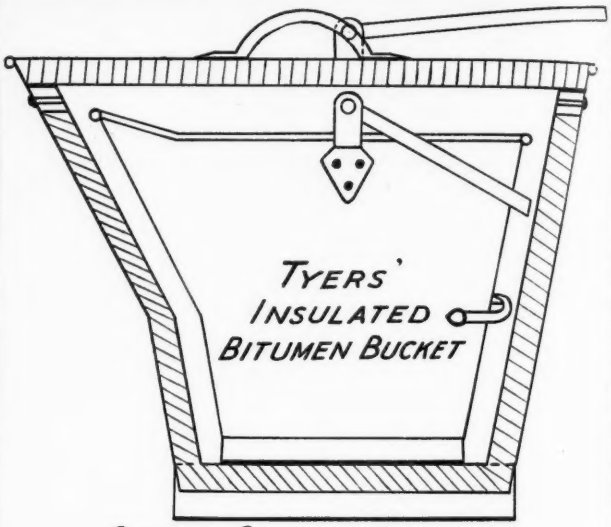

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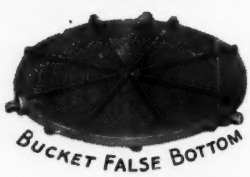

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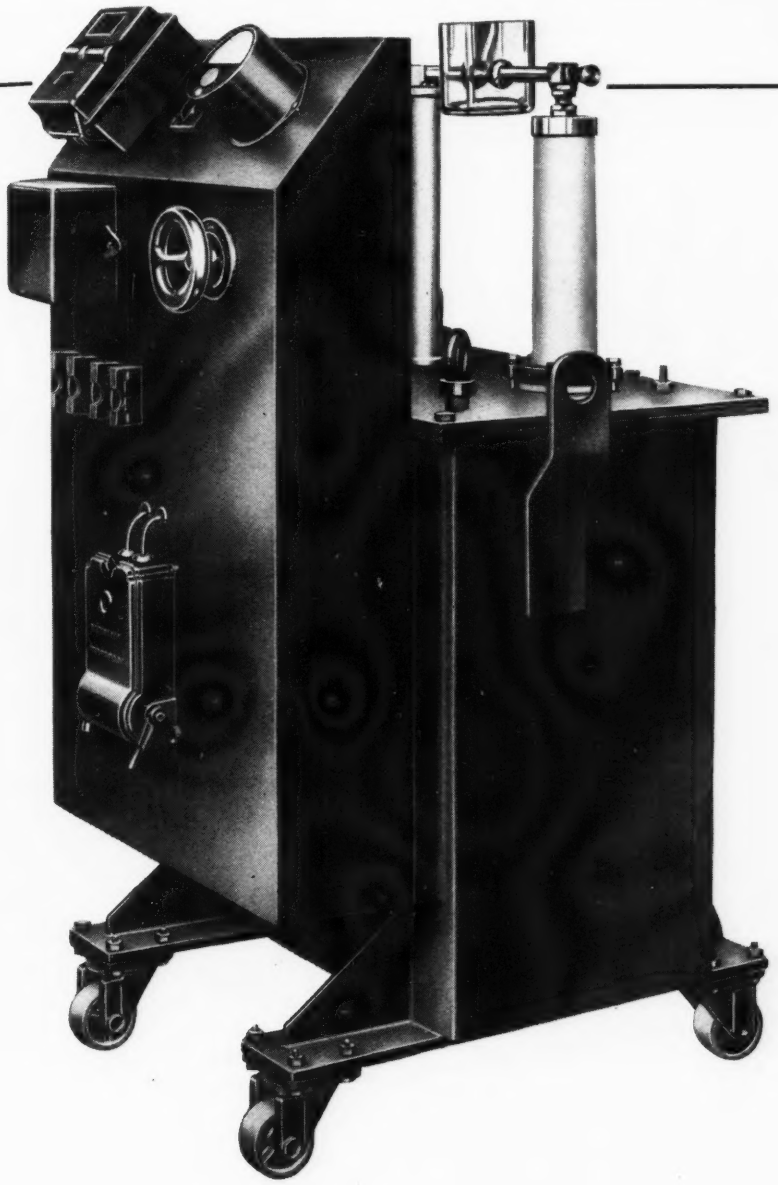

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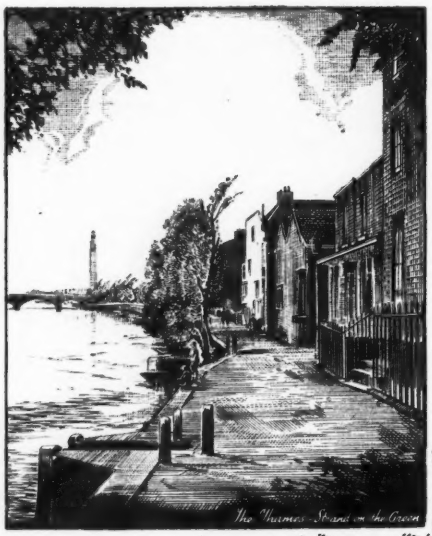

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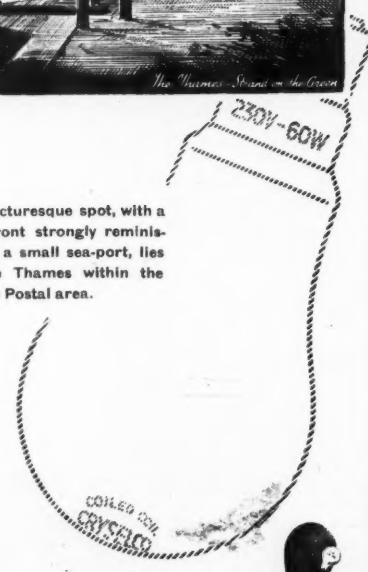

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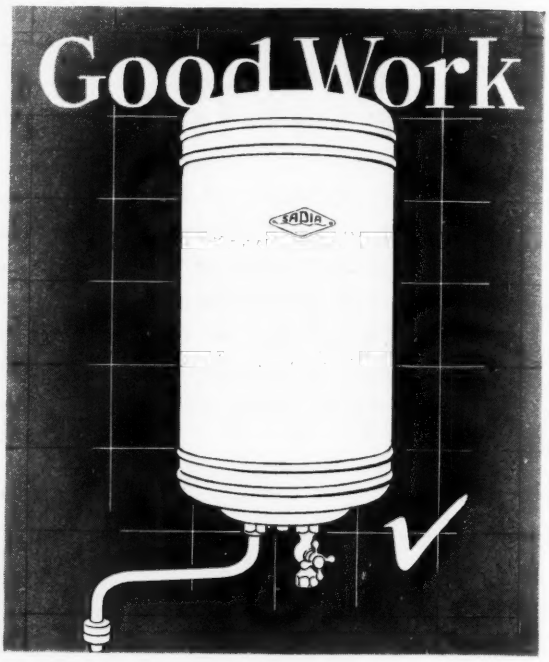
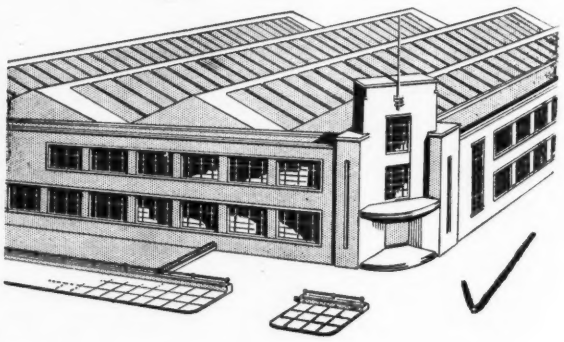


and good works



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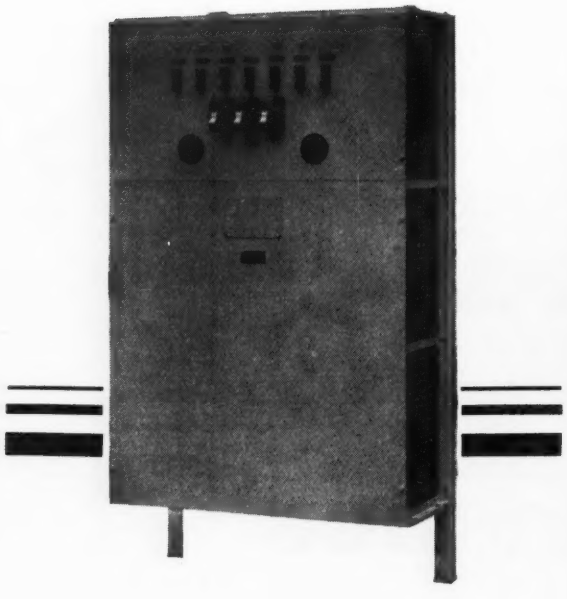

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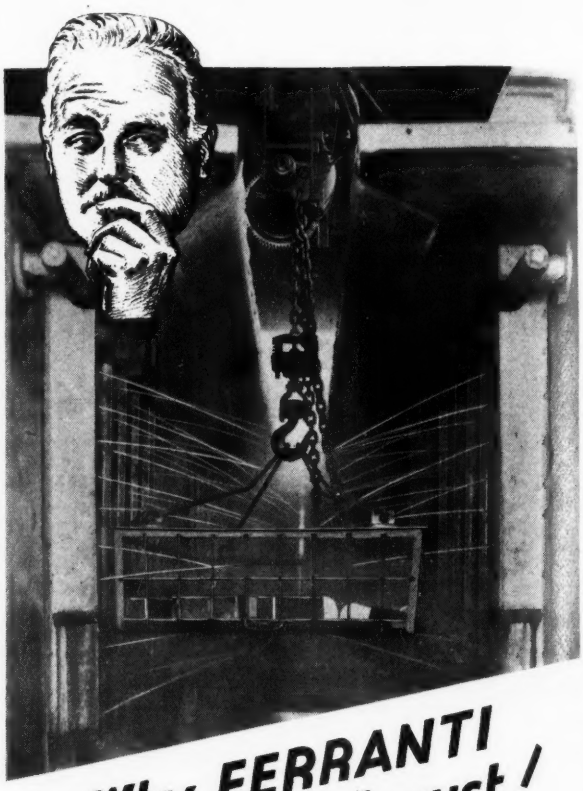

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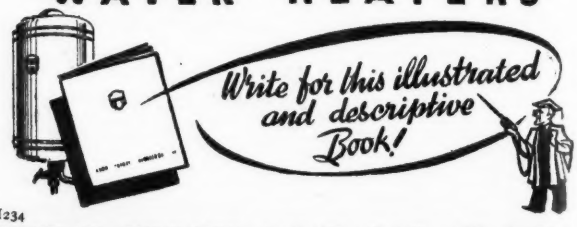

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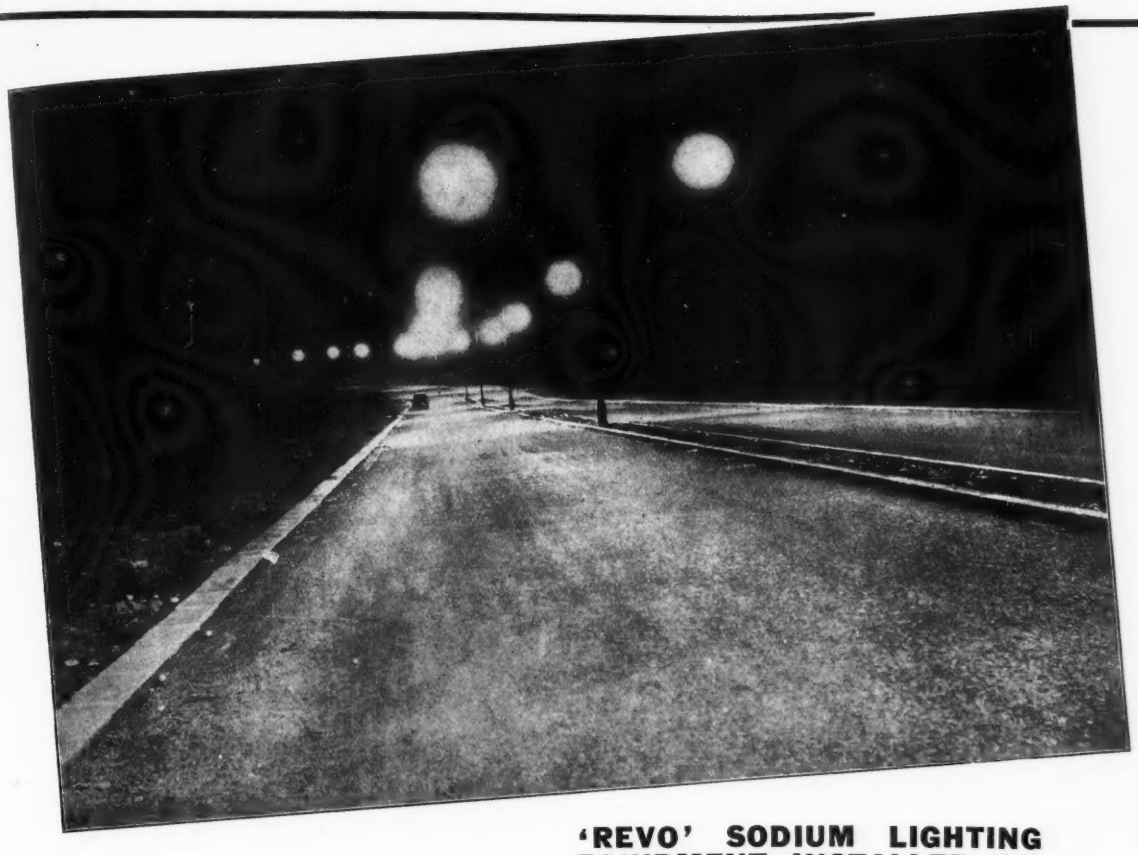

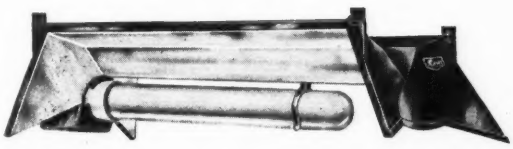

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Silvered Mirror fitting for use with 100w. and 150w. Sodium Lamps. Available for side of road mounting or centre suspension.

'REVO' SODIUM LIGHTING EQUIPMENT INSTALLED ON NEW ARTERIAL ROADWAY . . .

Following upon the successful installation of REVO Sodium Lighting equipment in other parts of Bolton, comes this extensive scheme on 'Moss Bank Way,' where 180 REVO C.9684(B.) Silvered Mirror Units equipped with 150W. Sodium Lamps are mounted on REVO Standards and Brackets to illuminate the dual carriageways of this modern highway.

Look how evenly the road surfaces are lighted, and the exceptional degree of visibility provided by the equipment.

Profit by the experience of the authorities responsible for this and many other miles of street lighting for which REVO fittings have been chosen. Write for latest Catalogue of equipment.

Revo

SODIUM STREET LIGHTING EQUIPMENT

REVO ELECTRIC CO. LTD. TIPTON. STAFFS.

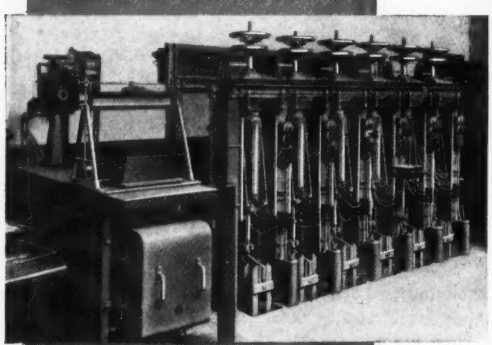
Research

Upon man's inspiration and effort, by a process of growth from the abstract idea to the concrete employment of materials and energy, depends the progressive utilisation of natural resources for the benefit of the community.

Transformation from the abstract idea or from new scientific knowledge to the stage of demonstrated utility is the major problem with which the "Metrovick" Research organisation is concerned.

For example

The "Metrovick" Research Laboratories have anticipated the steady increase in temperatures employed in modern steam practice by making a study of the creep of metals at high temperatures the subject of long and comprehensive research.



With the above creep testing apparatus tests on six specimens can be carried out simultaneously; extensometer equipment is incorporated which enables creep rates down to 10^{-8} strain per hour to be accurately measured at temperatures up to 750° C.

TURBO-ALTERNATORS

The illustration below shows the "Metrovick" 105,000 kW Turbo-alternator Unit installed in the Battersea Power Station of the London Power Company.

A "Metrovick" 67,000 kW Unit is also installed in this station and a further 100,000 kW Unit is in course of construction.

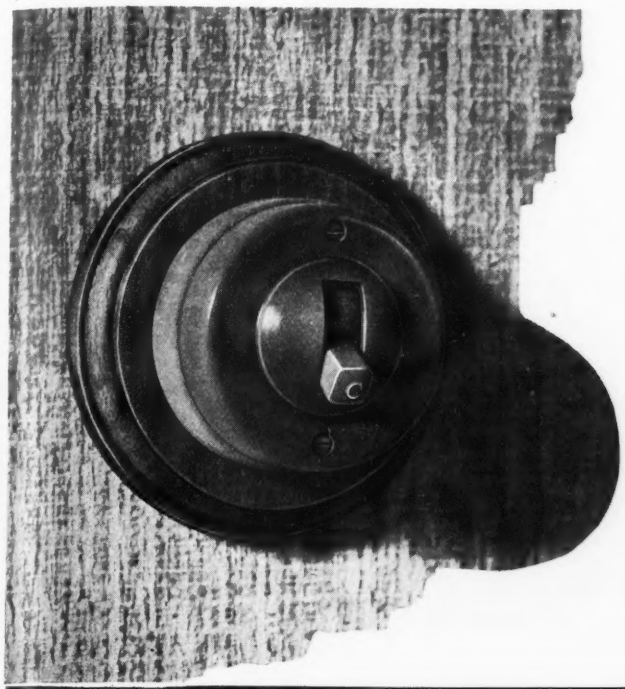
The Analyses of the Electricity Commissioners for 1935, 1936 and 1937—show Battersea to be THE MOST EFFICIENT POWER STATION IN GREAT BRITAIN.

METROPOLITAN Vickers
ELECTRICAL CO., LTD.
TRAFFORD PARK ··· MANCHESTER 17.

B 8802

COSMOS LAMPS

THERE'S A CRABTREE SWITCH FOR EVERY PURPOSE



1. "Lincoln" Type "Q.M.B." Switches

IT is sometimes overlooked that the lighting switches in a small house are operated more frequently than those in the medium and larger houses. Switches intended for the small installation, therefore, must be not only competitive in price, but also reliable in service. In both these respects, the "Lincoln" Type "Q.M.B." Switch has proved itself eminently suitable.

The switch mechanism, mounted on a base of highly vitrified porcelain, is of the quick make and break type. Every component is accurately machined to close tolerance limits. Moving parts in pressure contact with other surfaces are radius-edged and are bronze to brass—features which reduce friction to a minimum. The cover and reinforced dolly are soundly moulded from first quality "Jacelite" material.

The "Lincoln" Type "Q.M.B." Switch has been so successful in meeting the demand for reliability in a competitive form that it is now the most widely installed switch of its type in the United Kingdom.

CRABTREE

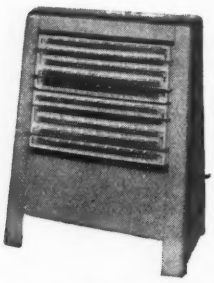
A name synonymous with Progress in Accessories and Switchgear

C.480/207. *Advt. of J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall, England.*

Reflector type fire in Ant. Silver or Ant. Copper with chromium-plated reflector.

D2708 {750 or 1,000 watts} **22/6**

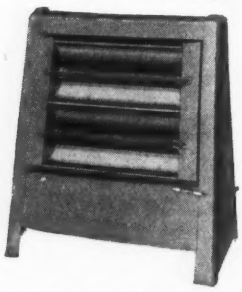
D2709 {1,500 or 2,000 watts} **35/-**



Sheet metal fire finished in Blue, Green, Bronze or Silver.

D2496 (1,000 watts) **10/6**

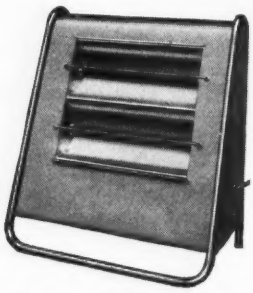
D2497 (2,000 watts) **18/6**



Sheet metal fire in Blue, Green, Bronze or Silver, with one or two chromium-plated reflectors.

D2498 (1,000 watts) **20/-**

D2499 (2,000 watts) **35/-**



Sheet metal fire in Blue, Green or Copper, with chromium-plated bent tube frame and one or two reflectors.

D2547 (1,000 watts) **27/6**

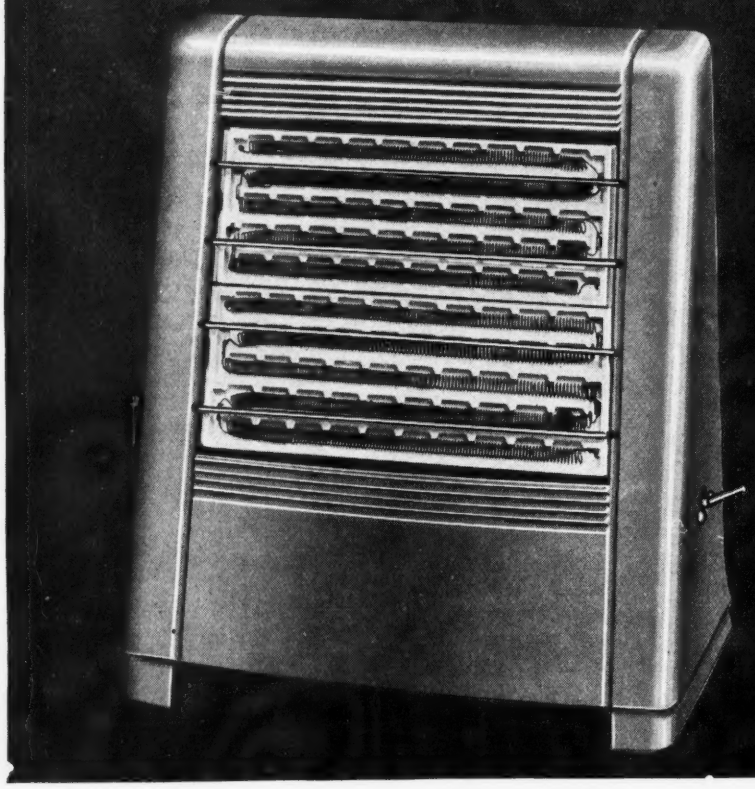
D2548 (2,000 watts) **45/-**

G.E.C.

ELECTRIC FIRES

★ *A Smart New Range for the*

DOMESTIC MARKET



Another wonderful value selected from

THE LATEST RANGE

A new and attractive cast iron fire designed to meet the ever-increasing demand for cheap and efficient radiators of pleasing appearance. Finished in Blue, Green, Beige or Black opaque vitreous enamel.

D2381 1,000 watts **17/6** D2382 2,000 watts **26/6** D2383 3,000 watts **39/-**

THE GENERAL ELECTRIC CO., LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT OR SITUATIONS WANTED.
Advertisements under these headings, if prepaid, are inserted at the rate of one penny per word (minimum 1s.). A box number counts as six words. (6d. extra charged for postage of replies.) If placed to account, the charge for each insertion is 2s. 6d. for three lines and 9d. for each additional line.
Three insertions—under the above headings only—can be secured for the price of two, if ordered and prepaid with the first insertion.
Original testimonials should not be sent with applications for employment.
Replies to Situations Vacant advertisements, published under a box number, if not to be delivered to any particular firm or individual, should be accompanied by instructions to this effect, addressed to The Manager of THE ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants in such cases cannot be returned to them. In no case will the name of an advertiser using a box number be disclosed.
Displayed advertisements :—14s. per inch (minimum one inch). (Three insertions at the cost of two if ordered and prepaid with the first insertion.)

"FOR SALE," "ARTICLES WANTED," "AGENCIES," "PARTNERSHIPS," etc.
Advertisements under these headings are inserted at the rate of 1s. 9d. per line per insertion. (This applies to all headings other than Situations Vacant or Wanted.)
Displayed advertisements :—14s. per inch (minimum one inch).

AUCTION NOTICES. 14s. per inch (minimum one inch).

ALL REPLIES TO BOX NUMBERS should be addressed to the Box Number, c/o THE ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED ADVERTISEMENTS must reach us by **5.30 p.m.** on **TUESDAY.**

OFFICIAL NOTICES.—TENDERS, ETC.

CITY AND COUNTY OF KINGSTON-UPON-HULL.

Electricity Department.

TENDERS are invited for the SUPPLY of the following STORES for a period of twelve months from 1st April, 1939 :— :

Schedule No. 1 : Switchfuses, Lampholders, etc.
,, ,, 2 : Joint Shells.
,, ,, 3 : Electricity Meters.
,, ,, 4 : Fuse Boxes.
,, ,, 5 : Meter Boards and Panels.
,, ,, 6 : Engineers' Stores.
,, ,, 7 : Insulating Tapes.
,, ,, 8 : Fuse Wire.
,, ,, 9 : Conduit and Fittings.
,, ,, 10 : Steam Pipe and Fittings.
,, ,, 11 : Plumbers' Material.
,, ,, 12 : Builders' Material.
,, ,, 13 : Tools.
,, ,, 14 : Cleansing Materials.
,, ,, 15 : Drysaltery, Grease, etc.
,, ,, 16 : V.I.R. and C.T.S. Flex.
,, ,, 17 : Copper Conductors.
,, ,, 18 : Overhead Line Fittings.
,, ,, 19 : Motor and Cycle Tyres and Accessories.

Tenderers must state the numbers of the Schedules required and these, together with the Forms of Tender, can be obtained from the General Manager, Electricity Department, Ferensway, Hull.

Tenders to be delivered by noon on the 17th January, 1939, in accordance with instructions contained in the Forms of Tender. 3386

CITY OF MANCHESTER.

THE Electricity Committee of the Manchester Corporation invites tenders for the supply and delivery during the period of twelve months ending 31st March, 1940, of :—

DOMESTIC ELECTRIC COOKERS.
(Specification No. 675.)

Specification and Form of Tender may be had on application to Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2, on payment of a fee of one guinea, which amount will be refunded on receipt of a bona fide tender.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall not later than 10 o'clock a.m. on Wednesday, the 18th January, 1939.

The firm entrusted with the work will be required to enter into a contract to be prepared by the undersigned.

The Corporation does not bind itself to accept the lowest or any tender.

R. H. ADCOCK,
Town Clerk.

Town Hall,
Manchester, 2.
23rd December, 1938. 3385

CORPORATION OF LIVERPOOL.

Electric Supply Department.

THE Corporation are prepared to receive Tenders for the supply and delivery, as required, during the twelve months ending March 31st, 1940, of the various materials scheduled below.

Firms are required to state clearly, when making application for the necessary Tender forms, the name and number of the form desired. Duplicate forms of tender for record purposes will not be supplied.

ES1.—Cables for Street Mains.
ES2.—Insulated Cables.
ES3.—Electric Meters.
ES4.—Incandescent Electric Lamps.
ES5.—Brass and Copper Castings.
ES6.—A.C. Electric Motors and Starting Gear.
ES7.—Stoneware Troughing, Tiles and Concrete Cable Covers.
ES8.—Creosoted Red Firwood Poles, Baulks and Cattle Guards.
ES9.—Electric Cookers, Kettles and Washboilers.

Tender forms will be forwarded upon receipt of application in writing to :—

The City Electrical Engineer,
24, Hatton Garden,
Liverpool, 3.

The Corporation do not bind themselves to accept the lowest or any tender and reserve the right to accept any portion of a tender.

The Tender, when completed, should be sent by post addressed to The Town Clerk, Municipal Buildings, Liverpool, 2, in the envelope provided by the City Electrical Engineer.

Latest date for receipt of tenders, 12 noon, Friday, January 13th, 1939.

W. H. BAINES,
Town Clerk.

3rd December, 1938. 3363

CITY OF CARDIFF.

Electricity Department.

TENDERS are invited from Manufacturers on the King's Roll for six 1,000 kVA 3-phase O.N. type Transformers.

Specification and form of tender may be obtained from the City Electrical Engineer and Manager, Central Offices, The Hayes, Cardiff.

Tenders enclosed in plain sealed envelopes and endorsed as stated in the specification must be delivered to the undersigned not later than 10 a.m. on Monday, 16th January, 1939. No tender will be received except in a plain sealed envelope which shall not bear any name or mark indicating the sender.

The lowest or any tender will not necessarily be accepted.

D. KENVYN REES,
Town Clerk.

City Hall,
Cardiff.
22nd December, 1938. 3387

OFFICIAL NOTICES.—TENDERS, ETC.—*Contd.*

METROPOLITAN BOROUGH OF STOKE NEWINGTON.

Electricity Department.

ANNUAL CONTRACTS.

TENDERS are invited for the Council's requirements during the year ending 31st March, 1940, for the following:—

(a) E.H.T. and L.T. Paper Cables and Cable Laying.
(b) Electric Cookers.
(c) Electric Kettles.
(d) Electric Washboilers.
(e) Electric Water Heaters.
(f) Control Units (Cookers).
(g) Conversion to A.C. of D.C. Wireless Apparatus.
(h) Solder.
(i) Wiring on Consumers' Premises.
(j) Meters—House Service.
(k) Underground Disconnecting Boxes.
(l) Plumbing and Fixing Water Heaters.
(m) Meter Boards.

Full particulars, specifications and form of tender may be obtained from the Borough Electrical Engineer, Electricity Offices, Edwards Lane, Stoke Newington Church Street, London, N.16.

The Council does not bind itself to accept the lowest or any tender and reserves the right to accept any portion of a tender.

Tenders must be delivered to the undersigned not later than first post Thursday, the 12th January, 1939.

C. KENT WRIGHT,
Town Clerk.

Town Hall,
Stoke Newington, N.16. 3381

BOROUGH OF MORECAMBE AND HEYSHAM.

Electricity Department.

CONTRACT FOR SUB-STATION EQUIPMENT.

THE Council of the Borough of Morecambe and Heysham invite Tenders from manufacturers for the supply and delivery of the following Sub-Station Equipment:—

E.D. 45.—Six 400 kVA Transformers.

Copies of the Specifications and Forms of Tender for the above may be obtained from Mr. P. Clegg, B.Sc., A.M.I.E.E., Borough Electrical Engineer, Electricity Offices, Woodhill Lane, Morecambe and Heysham.

Tenders to be sent in plain sealed envelope bearing the words "Tender for Sub-Station Equipment," addressed to the undersigned, and to be received not later than the first post on Monday, January 16th, 1939.

The Council do not bind themselves to accept the lowest or any Tender.

ROGER ROSE,
Town Clerk.

Town Hall,
Morecambe and Heysham.
December 19th, 1938. 3362

COUNTY BOROUGH OF WEST HARTLEPOOL.

Electricity Department.

TRANSFORMERS.

TENDERS are invited for the supply and delivery of FOUR 300 kVA, Single Phase, 50 cycles, 5,800/460-230 volts Transformers and ONE 300 kVA, Single Phase, 50 cycles, 10,750/460-230 volts Transformer, in accordance with the Specifications which may be obtained from the undersigned.

Tenders addressed to the Chairman of the Electricity Committee must be delivered at the Town Clerk's Office, Municipal Buildings, West Hartlepool, not later than 18th January, 1939.

No Tender will be received unless it is enclosed in a plain sealed envelope, which must bear the words "Tender for Transformers," but shall not bear any name or mark indicating the sender.

The Corporation does not bind itself to accept the lowest or any tender.

S. TILLOTSON, A.M.I.E.E.,
Borough Electrical Engineer.

Electra House,
Church Street,
West Hartlepool.
21st December, 1938. 3379

OFFICIAL NOTICES.—TENDERS, ETC.—*Contd.*

CITY OF PORTSMOUTH.

Electricity Undertaking.

TENDERS are invited for the Equipment of Fire Protection for the existing 6.6 kV Switch House at Gunwharf Road, Portsmouth.

Specification and particulars may be obtained upon application to Mr. B. Handley, Engineer and Manager, 111, High Street, Portsmouth.

F. J. SPARKS,
Town Clerk.

Guildhall,
Portsmouth,
23rd December, 1938. 3399

CITY OF PORTSMOUTH.

Electricity Undertaking.

TENDERS are invited from Cable Manufacturers for the supply, delivery and erection of SUPER TENSION CABLES with the necessary cable racks, etc., at the Electricity Generating Station, Gunwharf Road, Portsmouth.

Specification, Conditions and Form of Tender may be obtained from the Engineer and Manager, Electricity Undertaking, 111, High Street, Portsmouth, and must be returned to the undersigned in a sealed envelope marked "Tender for Cables," but without bearing any name or mark indicating the sender, on or before Monday, January 23rd, 1939.

F. J. SPARKS,
Town Clerk.

The Guildhall,
Portsmouth.
23rd December, 1938. 3384

THE Commissioners of His Majesty's Works, &c., are prepared to receive Tenders before 11 a.m. on Friday, 20th January, 1939, for Switchgear, Transformers, &c., for Sub-Station at Glascoed Royal Ordnance Factory.

Drawings, Specification, a copy of the Conditions and Form of Contract and Forms for Tender, may be obtained from Room 65D, Third Floor, H.M. Office of Works, London, S.W.1, on payment of One Pound. (Cheques payable to The Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in tenders in conformity with the conditions. 3377

SITUATIONS VACANT.

METROPOLITAN BOROUGH OF FULHAM.

Temporary (Male) Tracer.

APPLICATIONS are invited for the position of temporary male tracer in connection with the extensions of the Fulham Base Load Generating Station. Salary £2 15s. to £4 per week according to age and ability. The age of candidates must not exceed 35 years. Preference will be given to applicants having experience with electrical and mechanical engineering drawings.

Further particulars and a form of application may be obtained on sending a stamped, addressed, foolscap envelope to the undersigned, and completed applications endorsed "Tracer" must be delivered not later than 12 noon on Monday, 9th January.

Town Hall,
Fulham, S.W.6.

WILFRED TOWNEND,
Town Clerk.

3382

UNIVERSITY COLLEGE, LONDON.

APPLICATIONS are invited for the post of Assistant Lecturer in Electrical Engineering. Candidates must be graduates in Electrical Engineering. Preference will be given to a candidate who has had practical experience. Salary £250-£350, according to experience, with admission to the Federated Superannuation System. Further particulars may be obtained from the undersigned. Applications must be received on or before 14th January, 1939.

E. L. TANNER, Secretary.

University College, London (Gower Street, W.C.1). 3378

SITUATIONS VACANT.—*Continued.*

BOROUGH OF LUTON.

Electricity Showrooms.

APPLICATIONS are invited for the following appointments:—

(a) STOREKEEPER-CLERK. Applicants must have a sound knowledge of electrical appliances and accessories and be capable of controlling and keeping the records relating to the receipt and issue of stock.

Commencing salary: £205 per annum, rising by annual increments of £15 to a maximum of £250 per annum.

(b) HIRE AND HIRE-PURCHASE CLERK. Applicants must have a sound knowledge of hire and hire-purchase schemes and have had experience of keeping the records relating to such schemes.

Commencing salary: £180 per annum, rising by annual increments of £10 to a maximum of £200 per annum.

Each appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act, 1922, and the successful candidates will be required to pass a medical examination.

Applications, endorsed with the appointment for which application is made, stating age, qualifications, details of previous experience and accompanied by copies of three recent testimonials, should be received by the undersigned, not later than 16th January, 1939.

Canvassing, either directly or indirectly, will be a disqualification.

W. H. ROBINSON,
Town Clerk.

Town Hall,
Luton.
28th December, 1938. 3376

BOROUGH OF LOUTH.

Electricity Department.

APPLICATIONS are invited for the position of Assistant Consumers' Engineer, at a commencing salary of £156 per annum.

Candidates must have had previous experience in a similar position and possess the technical knowledge to advise consumers on tariffs and the use and installation of domestic electrical appliances.

The appointment may be designated as an established post under the provisions of the Local Government and Other Officers Superannuation Act, 1922, and the successful candidate may be required to undergo a medical examination.

Applications endorsed "Assistant Consumers' Engineer" should be in candidates' own handwriting, and should state age, experience, qualifications and present occupation, and accompanied by not more than three testimonials, must be delivered to the undersigned not later than 12 noon on Monday, 9th January, 1939.

Canvassing, either directly or indirectly, will disqualify.

H. DOUST,
Engineer and Manager.

Electricity Department,
Cannon Street.
Louth. 3388

AIR MINISTRY.

Directorate of Works.

APPLICATIONS are invited for temporary appointments as Mechanical and Electrical Engineering Assistants in the Drawing Office at the Air Ministry and in the Drawing Offices at R.A.F. aerodromes in the provinces at a salary up to £420 per annum according to qualifications and experience.

Only applicants with first-class training and experience, aged 30 to 45 years, will be considered.

Candidates must be capable of design work and preparing finished drawings of complete electrical power and lighting schemes for aerodromes, internal equipment of domestic buildings, workshops, aeroplane sheds. Preference will be given to candidates with mechanical engineering experience of power plants, water supply and sewage disposal works.

Requests for forms of application should be addressed to the Under-Secretary of State, Air Ministry (W.9), Adastral House, Kingsway, London, W.C.2, enclosing an addressed unstamped envelope. 35

SITUATIONS VACANT.—*Continued.*

METROPOLITAN BOROUGH OF FULHAM.

Boiler House Control Assistant.

APPLICATIONS are invited for the position of Boiler House Control Assistant at the Fulham Base Load Generating Station.

Applicants must not be more than 35 years of age, and must have had a sound technical education and experience in logging, recording and calculating boiler house statistics.

The commencing salary will be £292 10s. 7d. per annum in accordance with Grade 10, Class K of the National Joint Board Schedule, less 5 per cent. for superannuation.

Further particulars and a form of application may be obtained on sending a stamped, addressed, foolscap envelope to the undersigned. Applications endorsed "Boiler House Control Assistant" must be delivered to the undersigned not later than 12 noon on Monday, 9th January.

Town Hall,
Fulham, S.W.6.

WILFRED TOWNEND,
Town Clerk.

3383

ROYAL AIR FORCE.

TRAINING in useful trades is offered by the R.A.F. to men of good education. You may now enlist and be trained as Electrician or Instrument Repairer.

Experienced men are also required for enlistment in these trades. Age limits 17½-35. (Skilled Electricians only, up to 42.)

Apply for free booklet "A Life for Men" to R.A.F. Recruiting Depot, Victory House, Kingsway, W.C.2, or to any R.A.F. Recruiting Depot or Post Office. 3134

A METER Repairer used to A.C., D.C. and prepayment work. Wages in accordance with the district rate.—Apply by letter to the Carmarthen Electric Supply Co., Ltd., Electric House, 126, Lammas Street, Carmarthen. 8141

A VACANCY exists in an important electrical engineering firm for a man who has experience in the preparation or editing of technical articles. The essential qualifications are initiative and ability to put into form suitable for publication material which exists in rough notes, memoranda, etc. Some technical knowledge is necessary, but ability to write is the most important qualification.—Apply, giving details of past experience, qualifications and salary required, to Box 8121, c/o The Electrical Review.

A VACANCY occurs in a Northern Engineering firm for a Draughtsman, with experience on electric water heaters.—Applicants should state age, experience, and salary required to Box 3375, c/o The Electrical Review.

DESIGNER-Draughtsman required for Electrical Instruments, Manchester district. Good salary for man with right experience.—Age, salary and experience to Box 3395, c/o The Electrical Review.

DRAUGHTSMAN. Mechanical design of marine wireless and electrical equipment. Considerable experience on mechanical design of small electrical apparatus essential. Workshop experience desirable. Salary £4 10s. Locality, Essex.—Apply, stating qualifications, to Box 3391, c/o The Electrical Review.

DRAUGHTSMAN, mechanical, with first class experience of steam turbine work and generating plant arrangement.—Applications, stating age, experience and salary expected, to Box 3334, c/o The Electrical Review.

DRAUGHTSMAN required, age 22-24 years, experience in L.T. Electrical Control Gear, preferably with some shop experience.—Reply, stating age, experience and salary required, to Messrs. Dewhurst & Partner, Ltd., Inverness Works, Hounslow, Middlesex. 3368

DRAUGHTSMAN required for Fractional Horse-power Motor Department. Permanent position.—Write, stating age, experience and salary required, to the Engineer in Charge, Fractional H.P. Motor Dept., English Electric Co., Ltd., Bradford. 3397

DRAUGHTSMAN required for high class instrument design. Experience in Pyrometry desirable.—Apply, stating experience and salary required to Box 3396, c/o The Electrical Review.

DRAUGHTSMEN.—Well-known Midland electric manufacturing company invite applications from men experienced in the design and layout of all types of switchgear, diagram experience an advantage.—Write, stating age, qualifications, experience and salary expected, to Box 3372, c/o The Electrical Review.

SITUATIONS VACANT.—*Continued.*

ELECTRICAL.—A firm of Tubular and Space Heating Engineers in Scotland require a Manager for the Commercial side. Must be sound theoretically, capable of designing and estimating, following up prospects, controlling agents, and developing sales. Salary £200/£500 according to experience and ability.—Full particulars of experience, age and when at liberty, to Box 3393, c/o The Electrical Review.

ELECTRICAL Draughtsman (aged 25/35) required for London office of large company. Should possess ordinary or Higher National Certificate in Electrical Engineering. Must have had experience in A.C. layouts for mines, steelworks or large industrial works. Salary £295.—Reply, giving full particulars and stating age to Box 3366, c/o The Electrical Review.

ELECTRICAL Fitter required for maintenance of substations in Midlands. Experience of E.H.T. switchgear and on-load tap-changing gear essential. Applicants must be medically fit, under 40 years of age, and prepared to enter contributory superannuation scheme. Upstanding weekly wage 80s. to 84s. 9d., rising to 89s. 9d. after a period of satisfactory service, according to qualifications.—Reply, giving details of training and experience and copies of two testimonials, to Box 3335, c/o The Electrical Review.

ELECTRICAL Foreman for Plant Department Motor Car Factory equipped modern machine tools, many electrically driven. A.C. supply. Latest electric carburising and heat treatment furnaces with automatic control. Sound technical and practical knowledge and good disciplinarian essential. Give experience, particularly with regard to maintenance, inspection, and installation, qualifications and salary required, Plant Superintendent, Albion Motors, Ltd., Glasgow. 3398

ENGINEER (Costing) required at once by leading cable company to take charge of the costing of contracts. Applicant must have had experience in all the operations on installing all classes of electric cables both underground and in Power Stations and Factories.—Write, stating age, qualifications, experience and salary, to Box 3394, c/o The Electrical Review.

ENGINEER, fully experienced (workshop, drawing, design), required for taking complete charge of small progressive factory making special Transformers from 1 to 200 kVA.—Box 3351, c/o The Electrical Review.

ESTIMATING Engineer required for automatic control gear manufacturers, progressive job for man of ability.—Reply, giving fullest possible particulars, Box 8096, c/o The Electrical Review.

FOREMAN to take charge of radio component assembly shop. Must be first class production man, experienced in shop layout and capable of controlling mixed labour. Apply in writing in first instance, stating age, experience during last three years and salary required.—Goodmans Industries, Limited, Lancelot Road, Wembley. 3374

INSTALLATION Assistant required. Candidates should be experienced in control and execution of all classes of installation work, including estimating and office routine. Sound knowledge of all regulations essential, and mains experience desirable. Commencing salary in accordance with N.J.B. Schedule, Class B, Grade 8b.—West Hampshire Electricity Company, Limited, Electricity House, Lyndhurst, Hampshire. 3390

JUNIOR Assistant wanted for Technical and Testing work. Good technical training essential, experience in accurate electrical measurements desirable. South London area.—Particulars of training and experience, with age and salary required, to Box 8138, c/o The Electrical Review.

LAMPSHADES.—Representative with genuine Lampshade connection and car required by established firm of manufacturers for Lancashire, Cheshire and North.—Box 3364, c/o The Electrical Review.

LONDON house, electrical and general goods, require representatives, London, Midlands, Leeds, Newcastle, South Wales, East Coast. Good commission. Car owners, may carry other goods.—Box 8130, c/o The Electrical Review.

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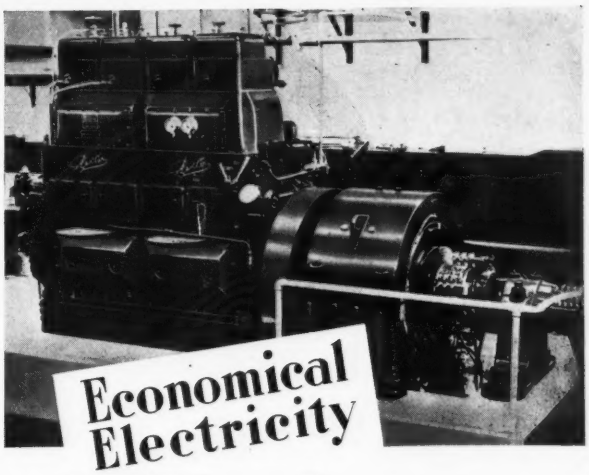

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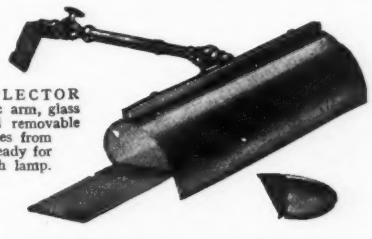

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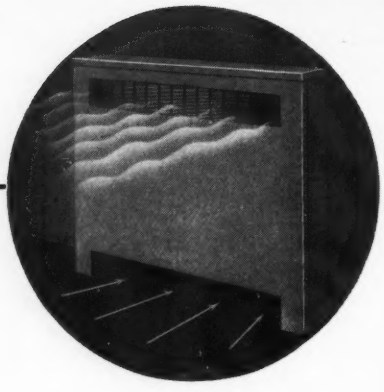

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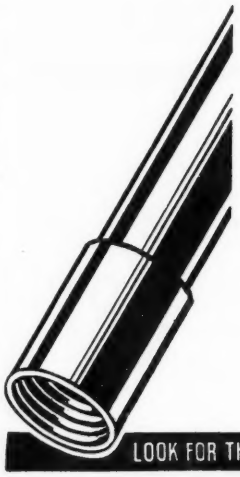

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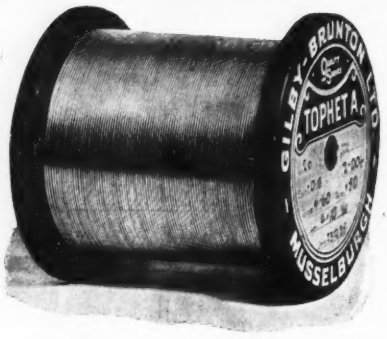

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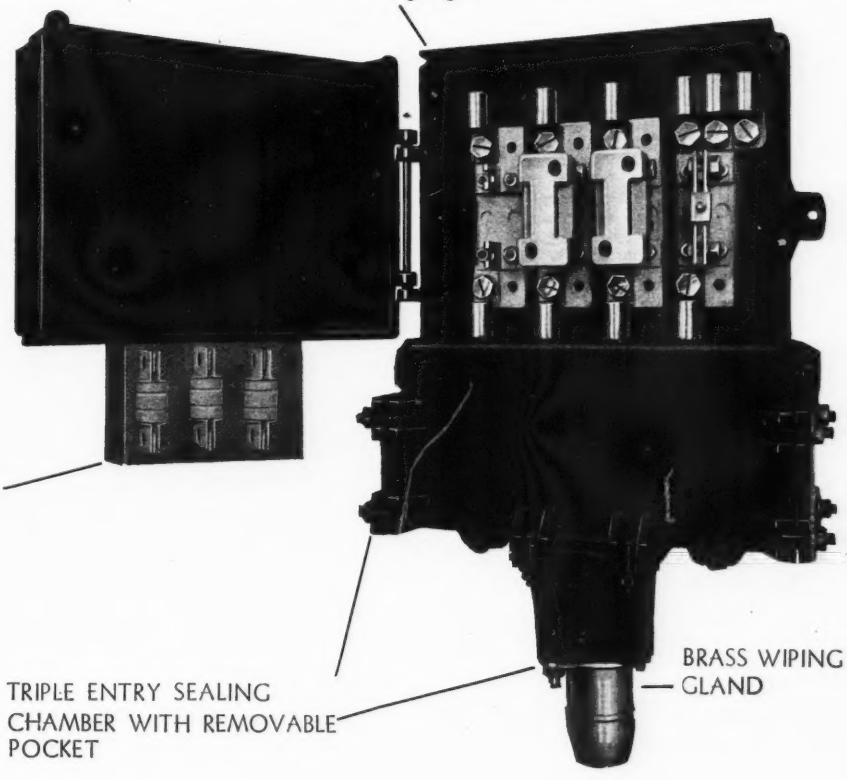
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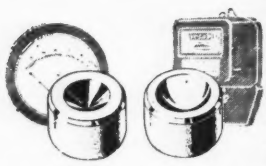

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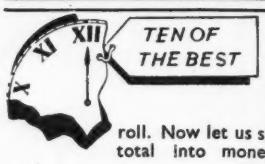

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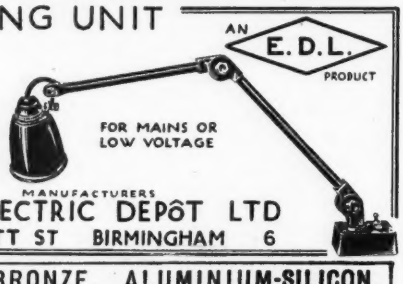

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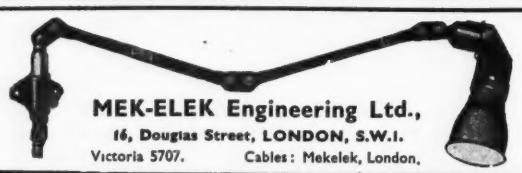

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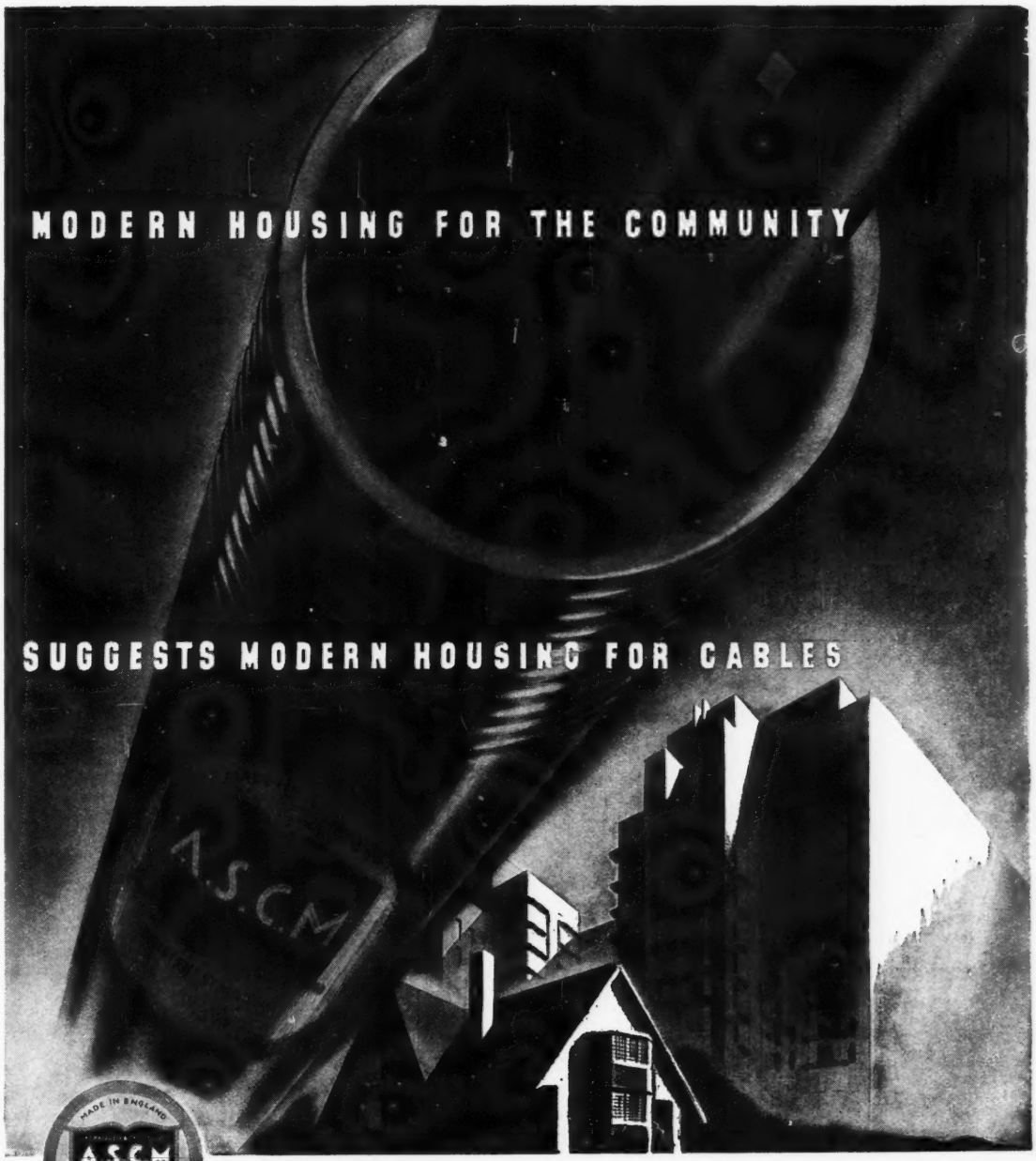

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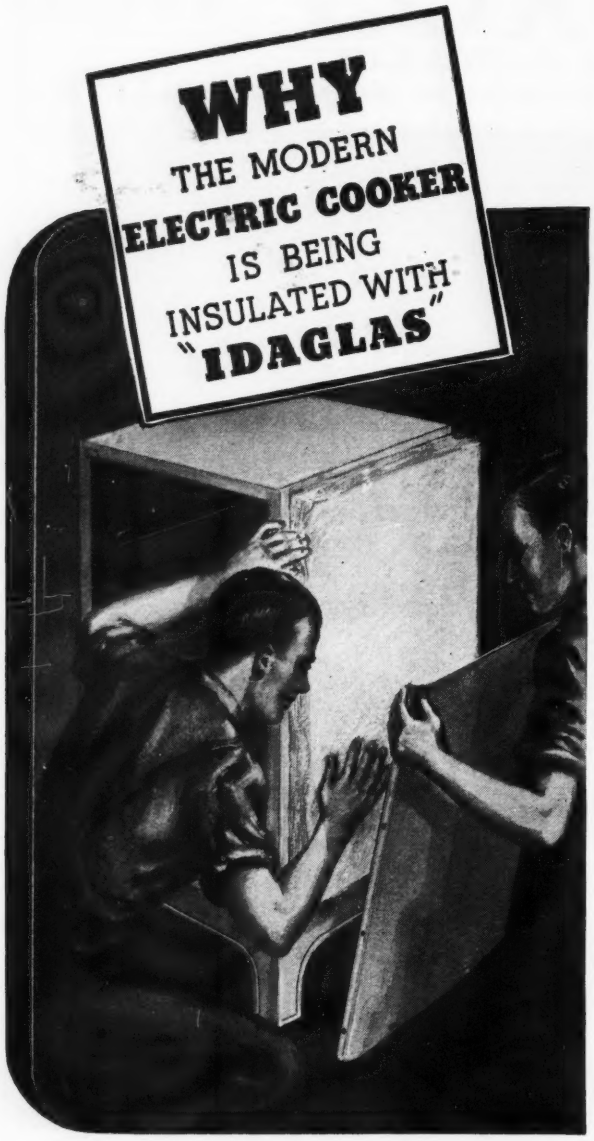

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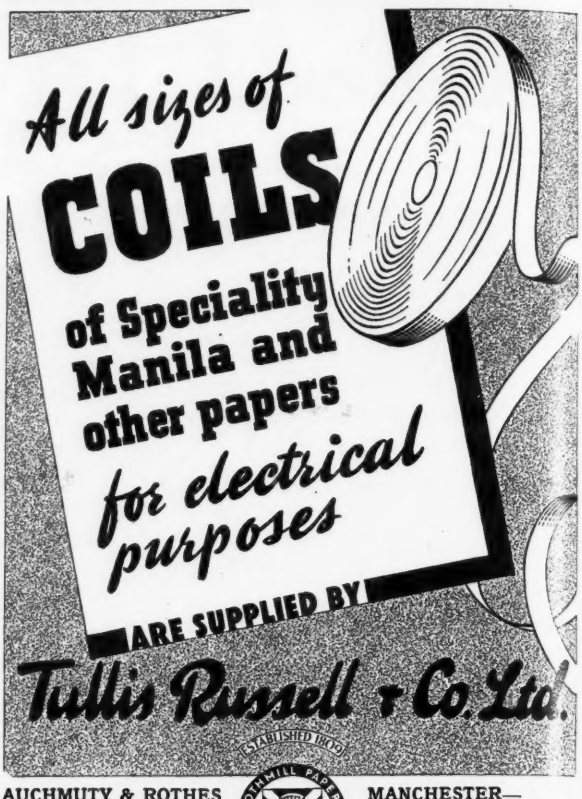

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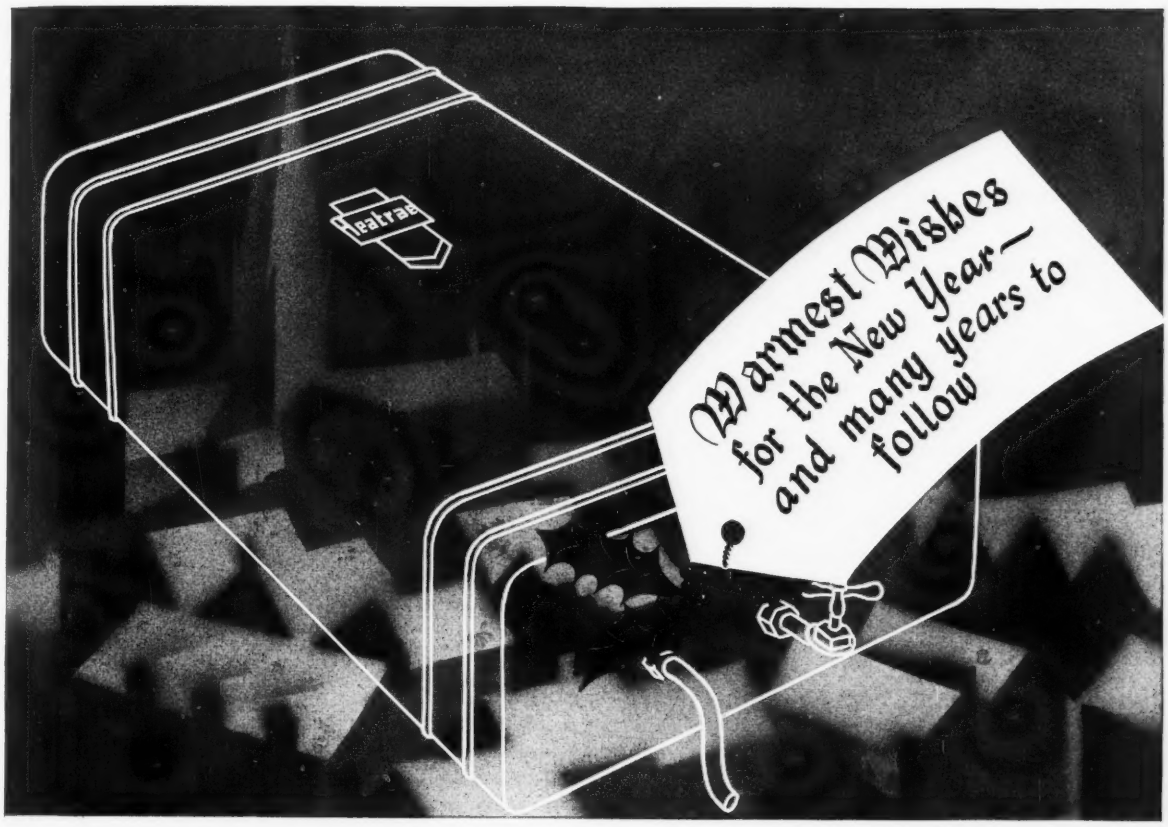

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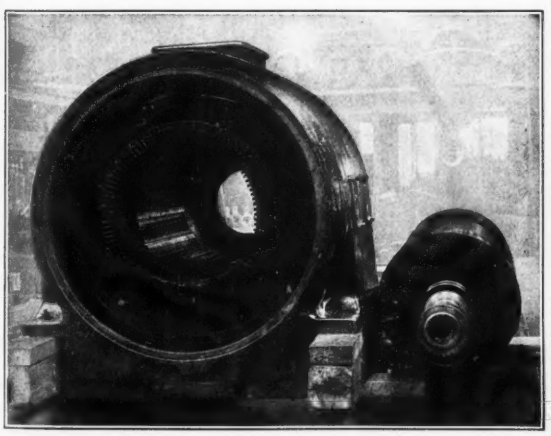

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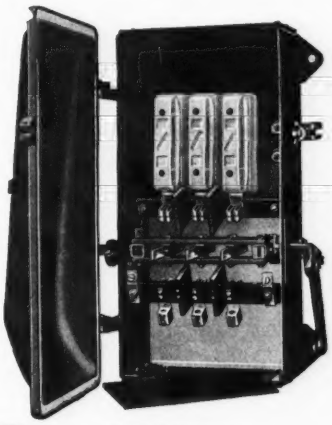

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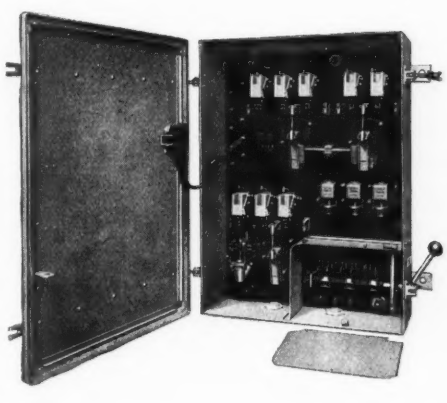

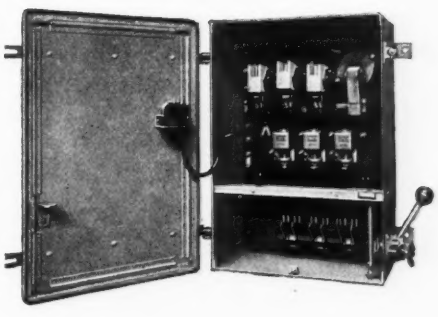

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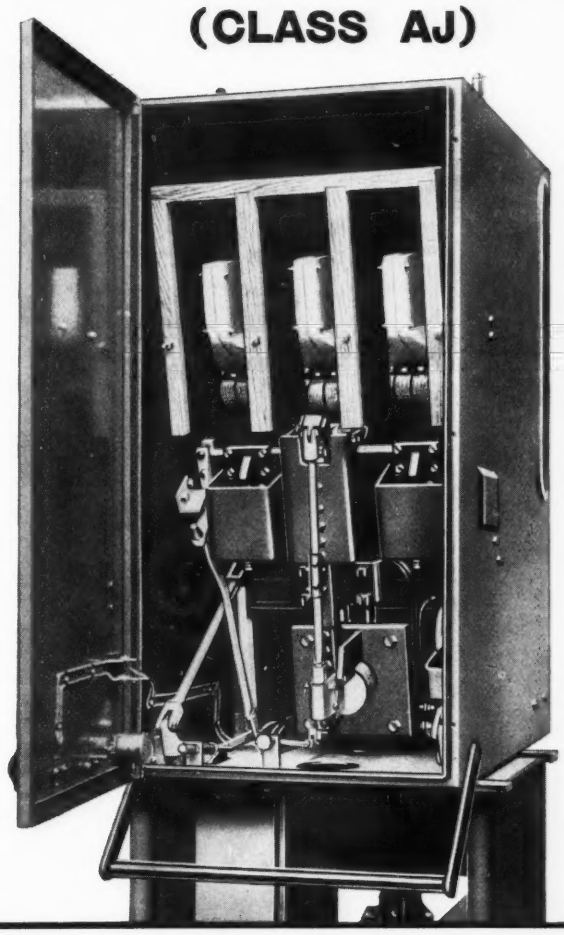

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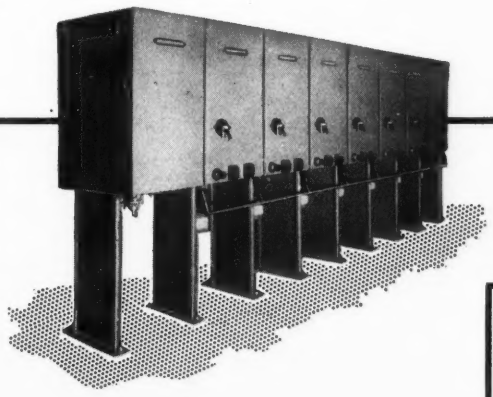

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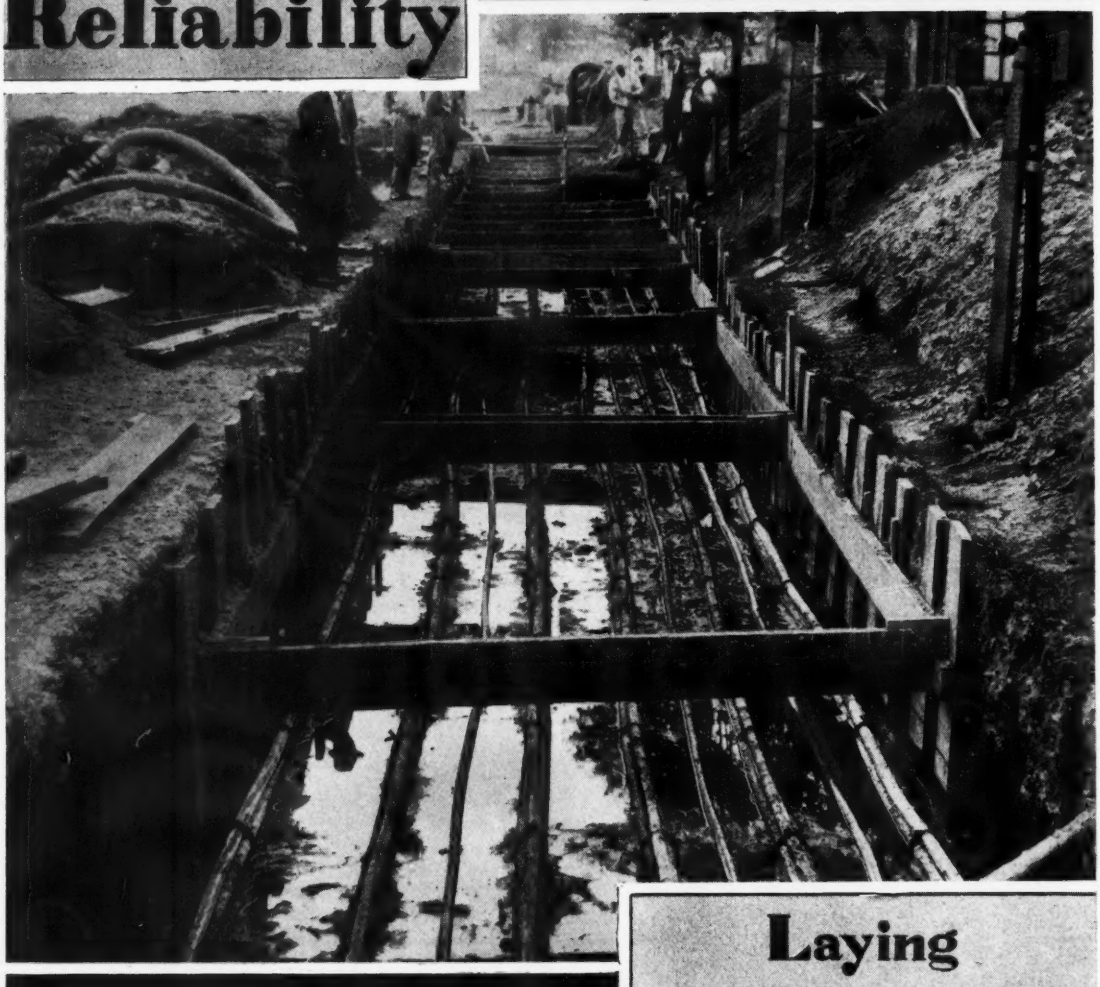

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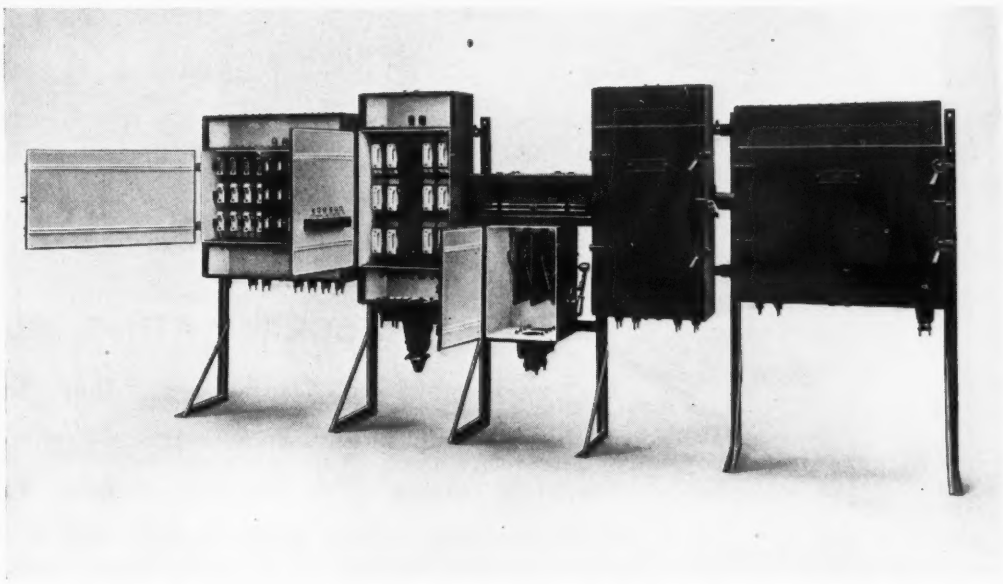

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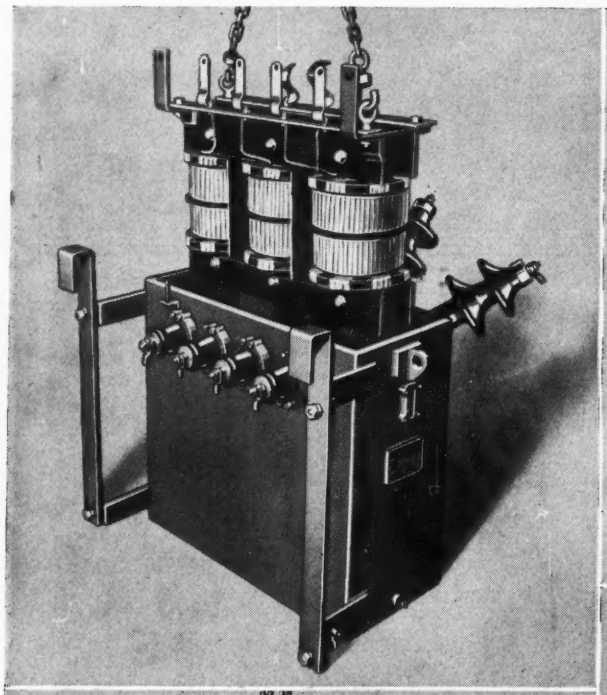

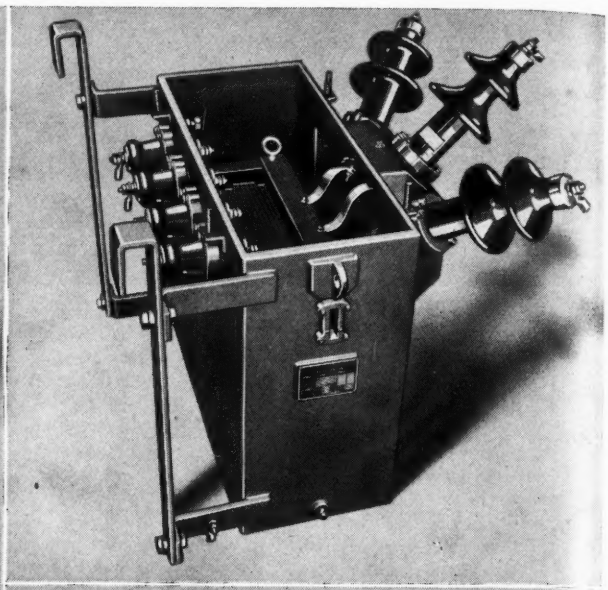

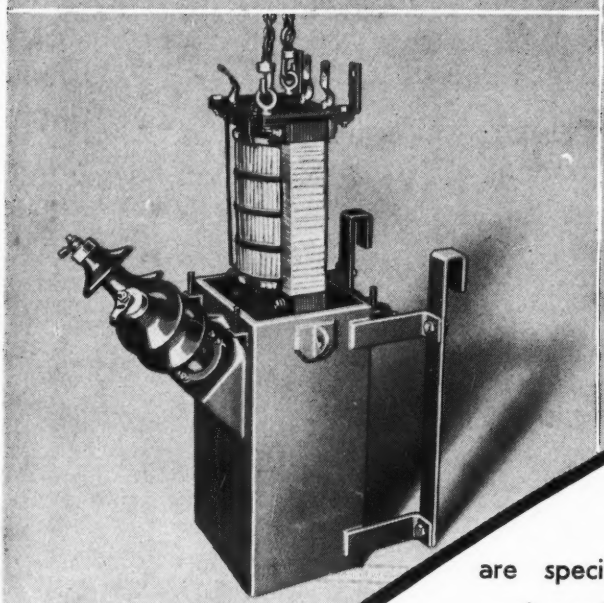

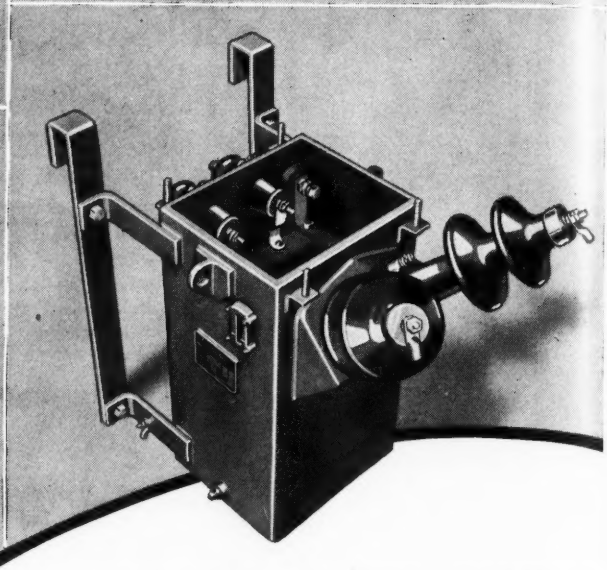

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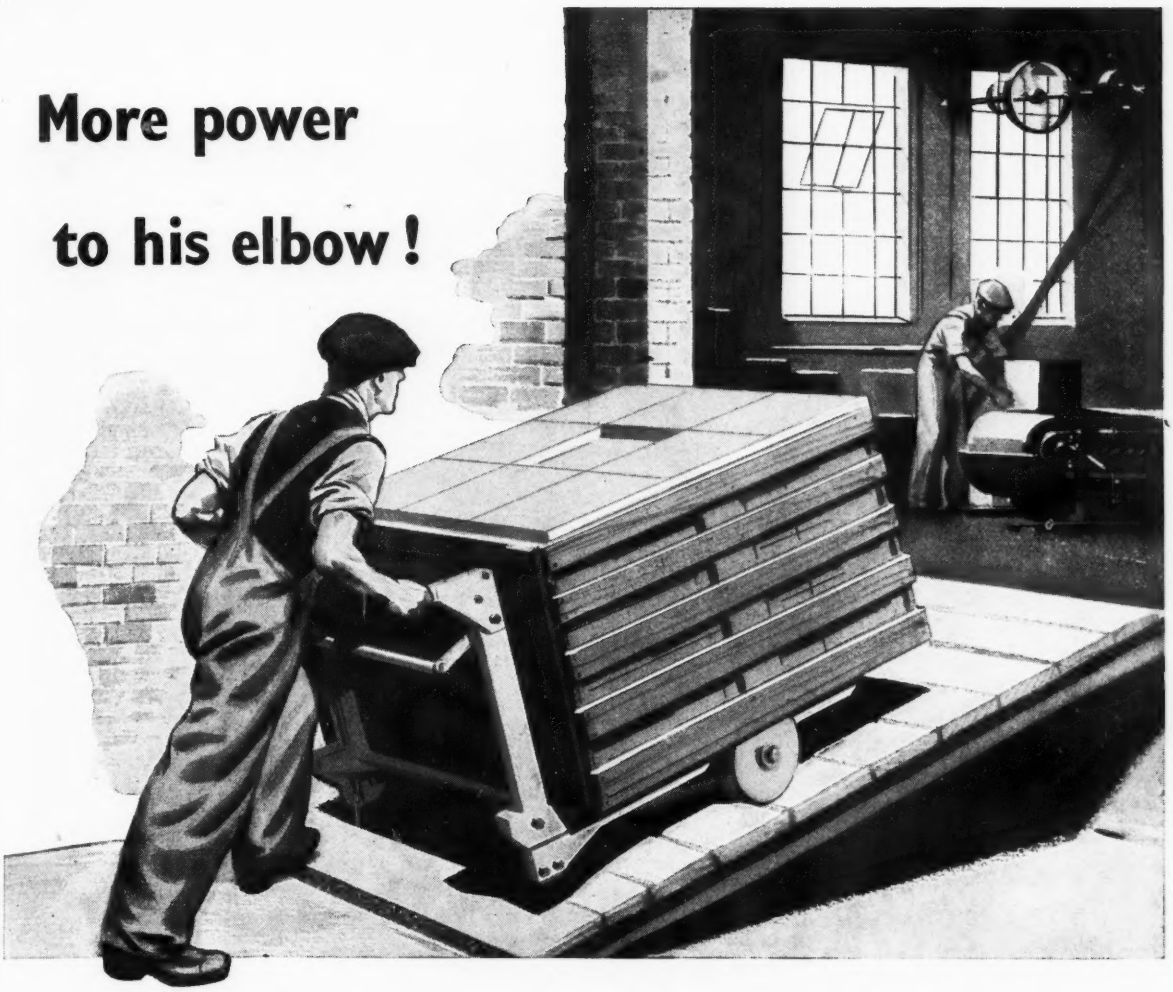

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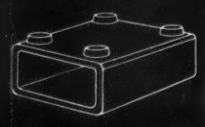
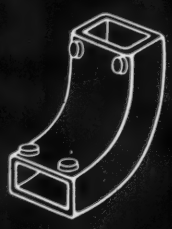

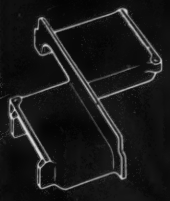
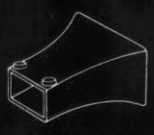

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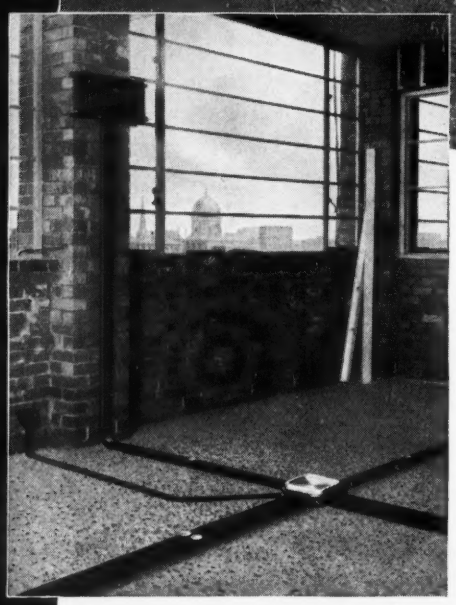
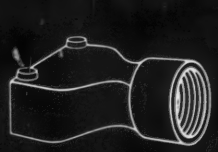
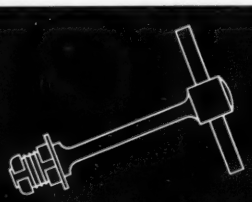
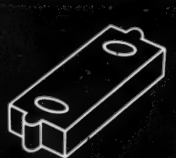


SIMPLEX
UNDER-FLOOR DUCT SYSTEM

● The photographs show part of an installation of the Simplex Under-Floor Duct System in a large administrative block.

The system is fully explained in List No. D1637, copy on request.



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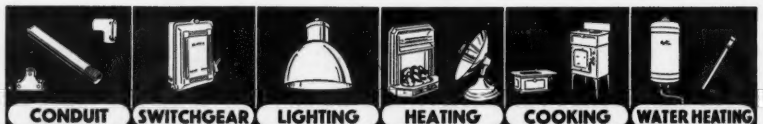

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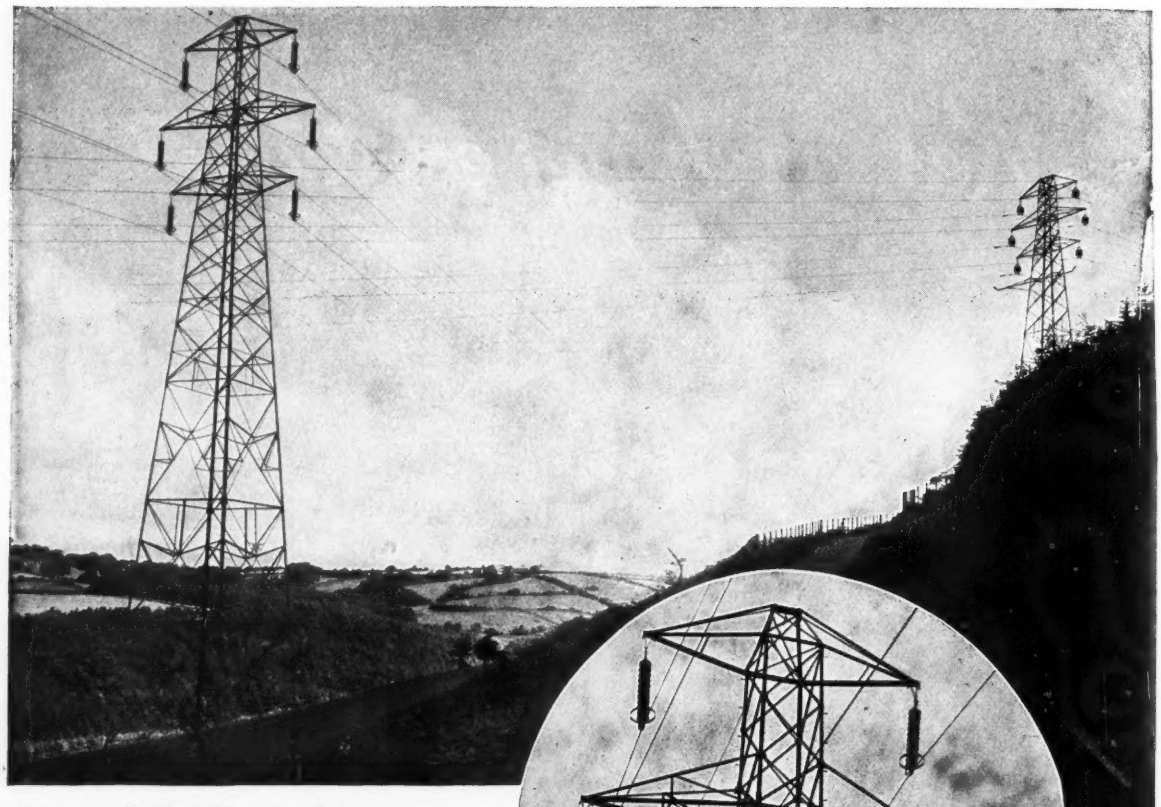

One of the heaviest overhead transmission lines ever erected

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Here are brief facts and figures regarding this 132 kV. Henley line recently completed between Upper Boat and Ebbw Vale in South Wales.

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18¾ miles

Conductors :
6—.175 sq. in. A.C.S.R. line conductor with .07 sq. in. A.C.S.R. earth conductor.

Towers :
Ranging in height from 89 to 129 feet, 132 were erected. 46 were angle positions.

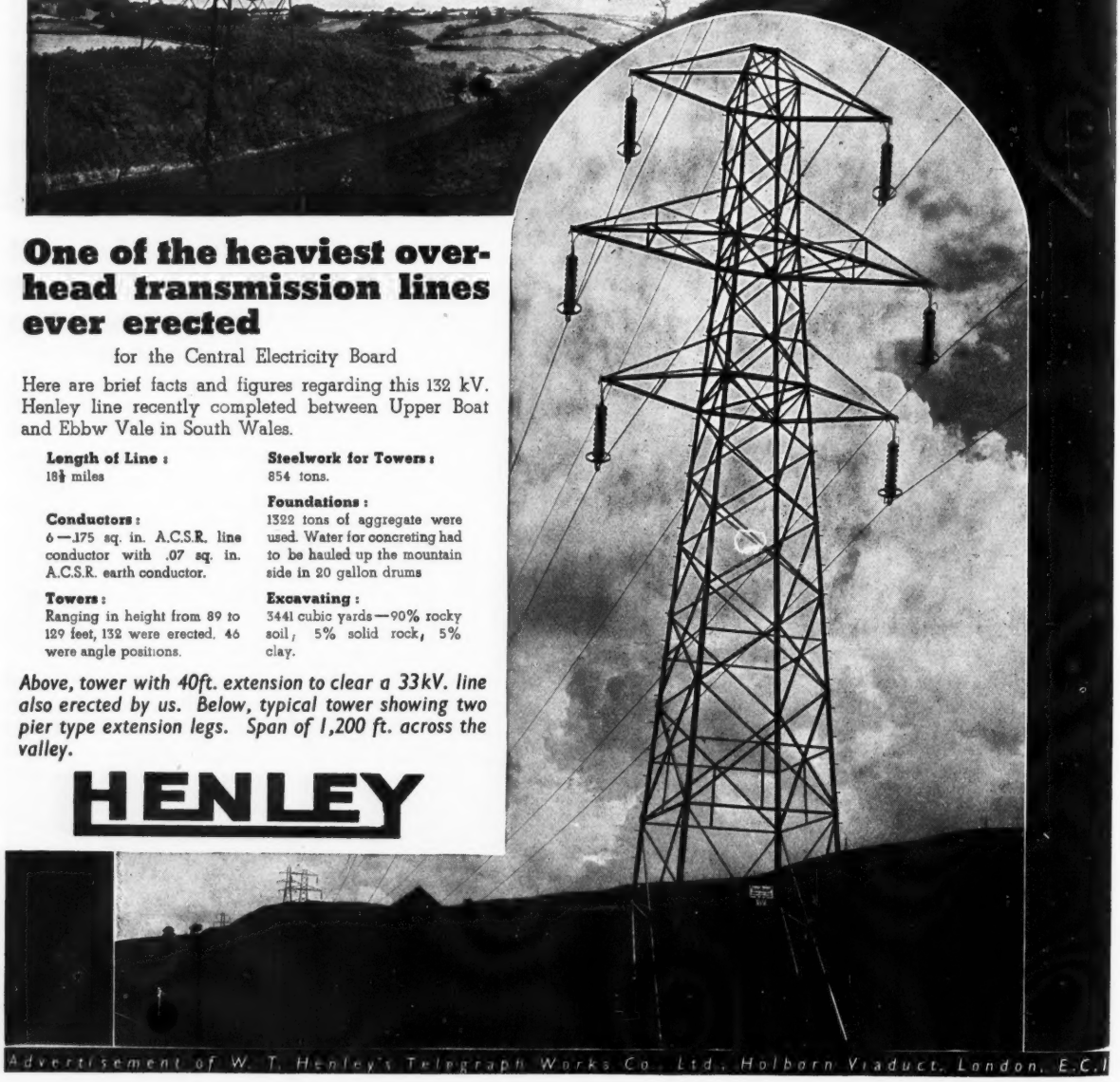
Steelwork for Towers :
854 tons.

Foundations :
1322 tons of aggregate were used. Water for concreting had to be hauled up the mountain side in 20 gallon drums

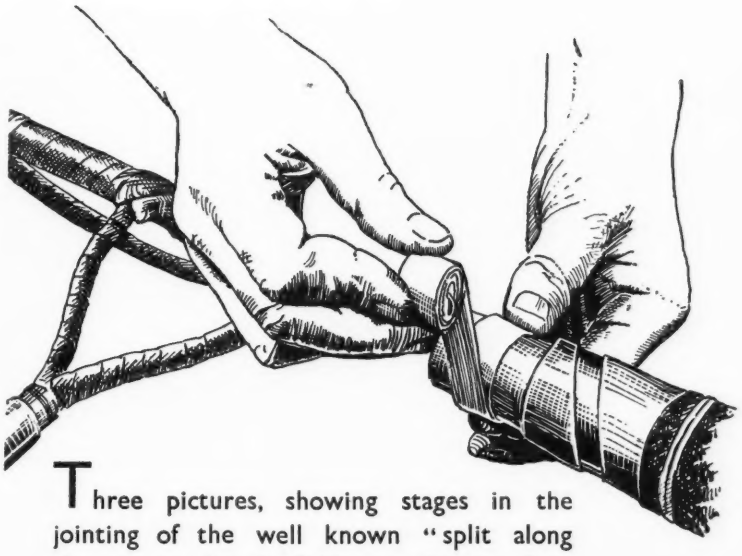
Excavating :
3441 cubic yards—90% rocky soil; 5% solid rock; 5% clay.

Above, tower with 40ft. extension to clear a 33kV. line also erected by us. Below, typical tower showing two pier type extension legs. Span of 1,200 ft. across the valley.

HENLEY



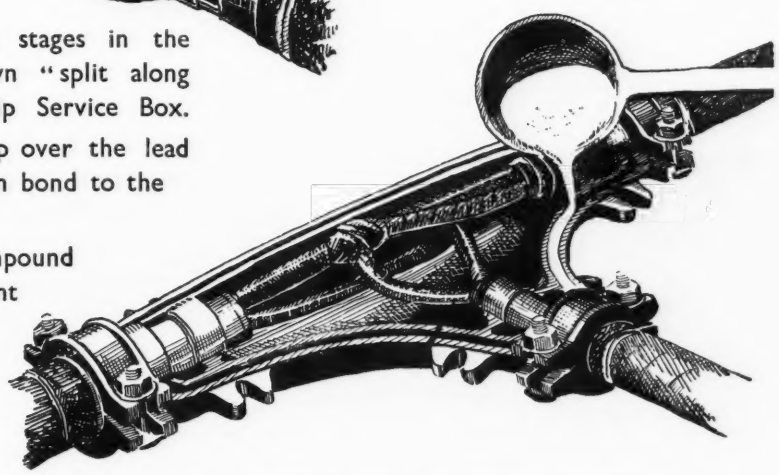
Advertisement of W. T. Henley's Telegraph Works Co. Ltd., Holborn Viaduct, London, E.C.1

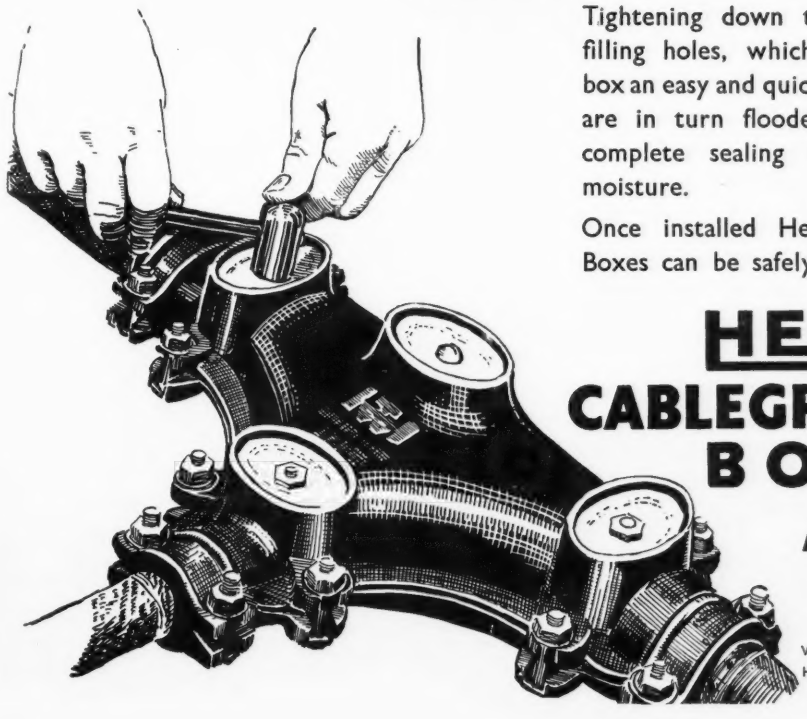


Three pictures, showing stages in the jointing of the well known "split along the centre line" Cablegrip Service Box.

Applying the lead alloy strip over the lead sheathing to obtain a certain bond to the cast iron box.

Filling with waterproof compound the tongue-and-groove joint between the two halves of the box thus ensuring a watertight joint.





Tightening down the covers of the large filling holes, which make the filling of the box an easy and quick operation. These covers are in turn flooded with compound giving complete sealing against the ingress of moisture.

Once installed Henley Cablegrip Service Boxes can be safely forgotten.

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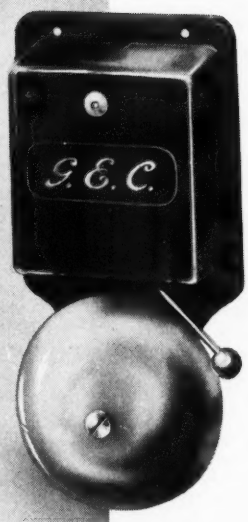

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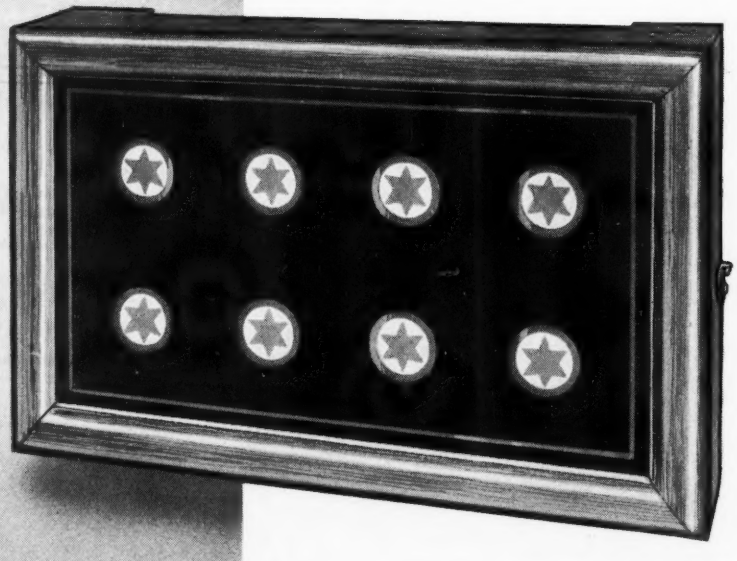

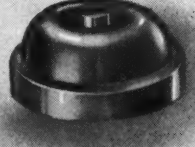

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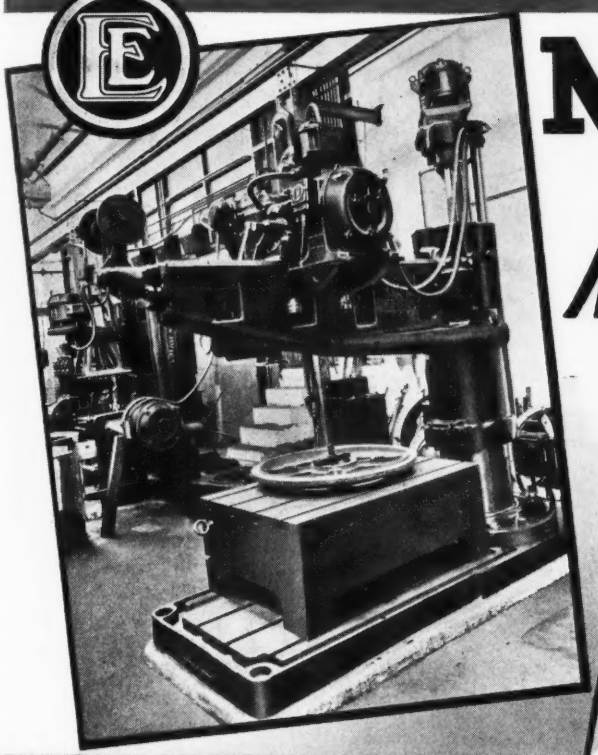

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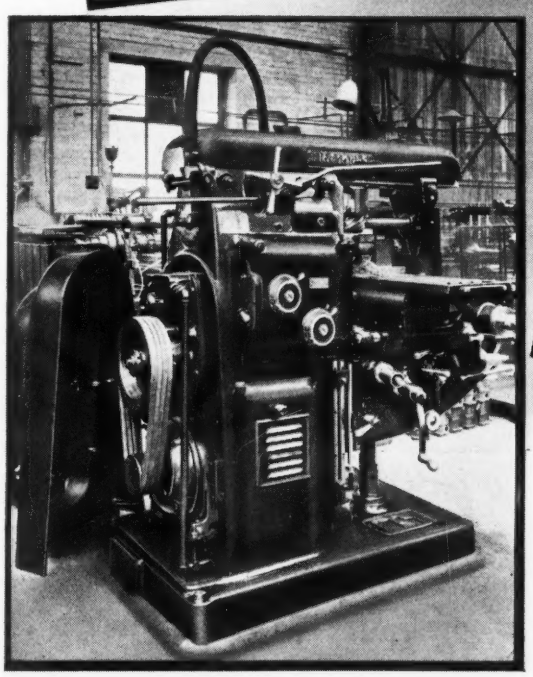

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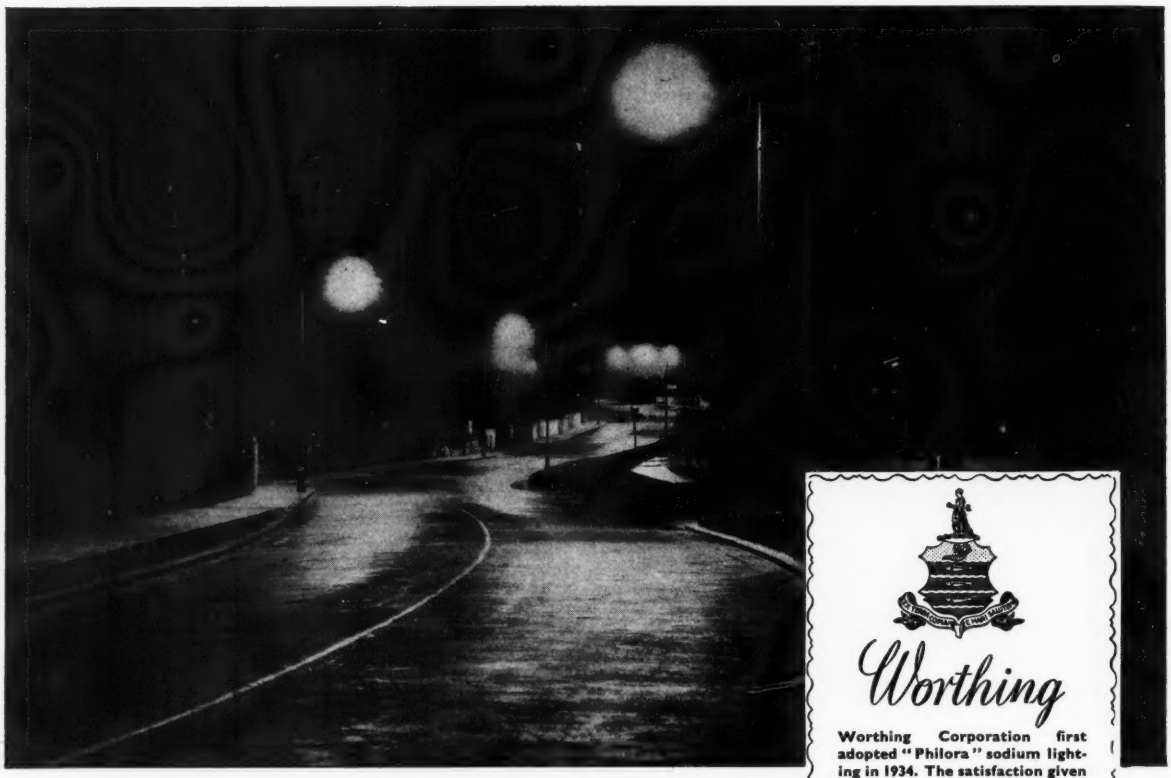

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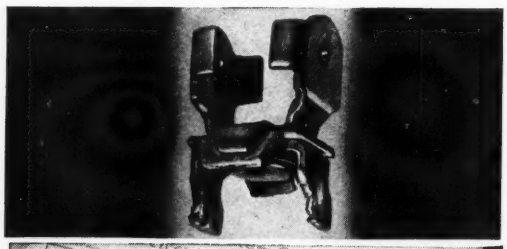

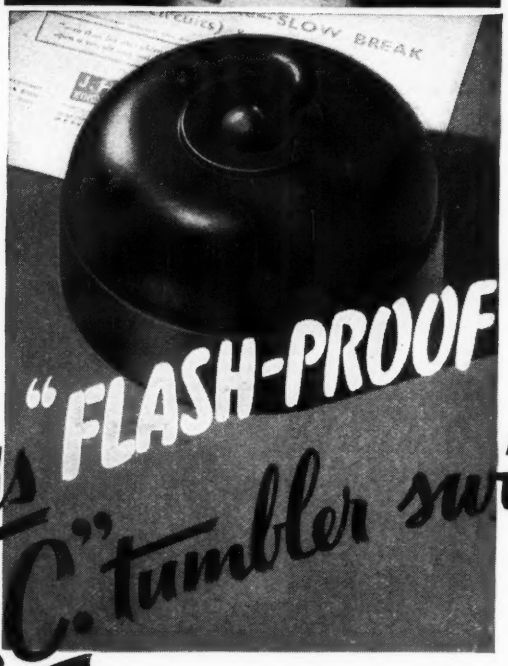

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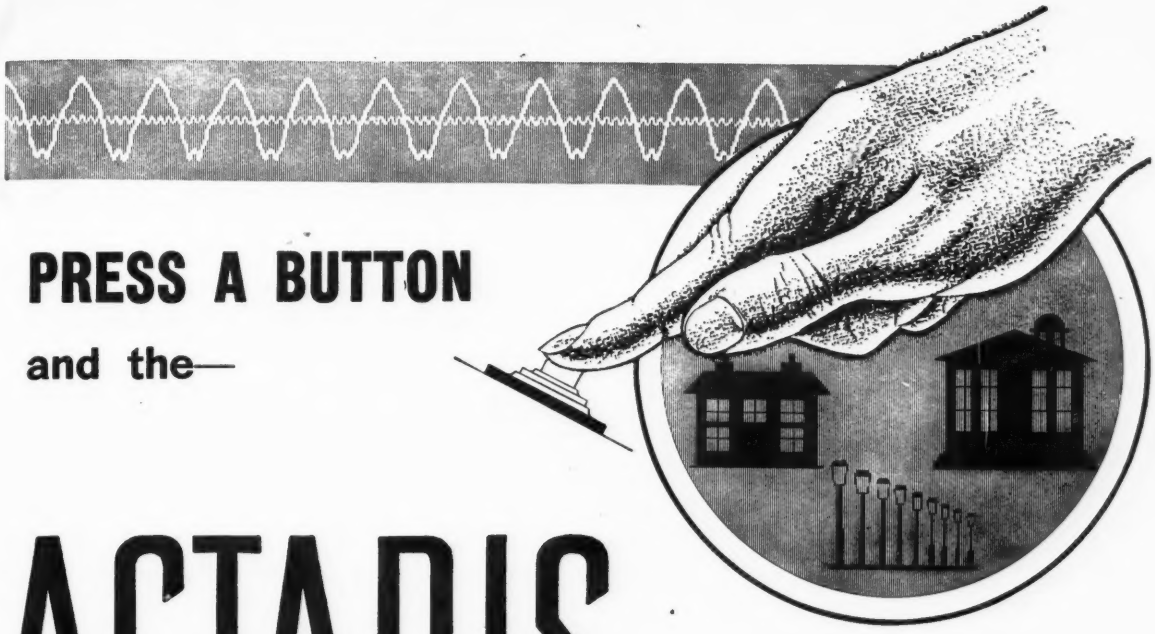

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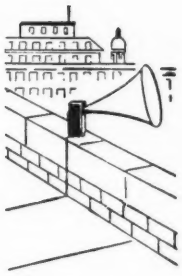

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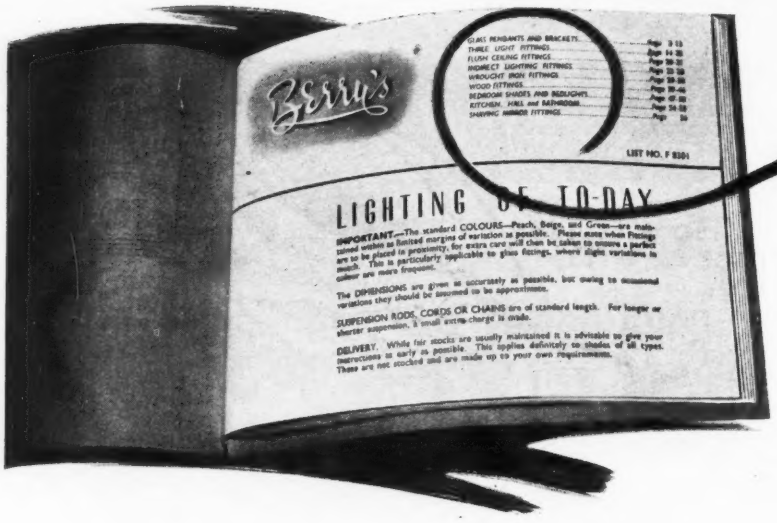

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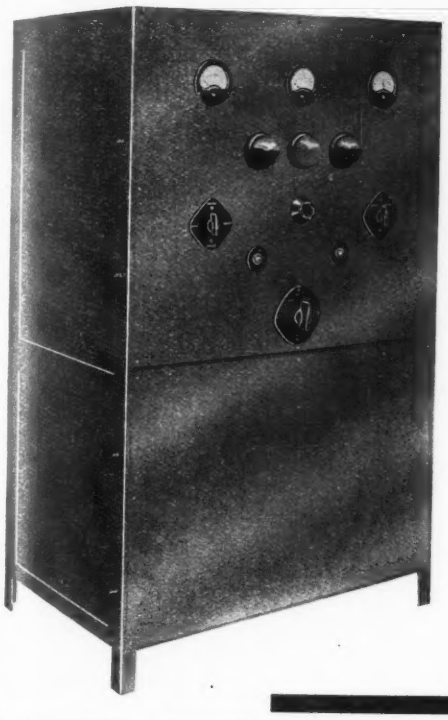

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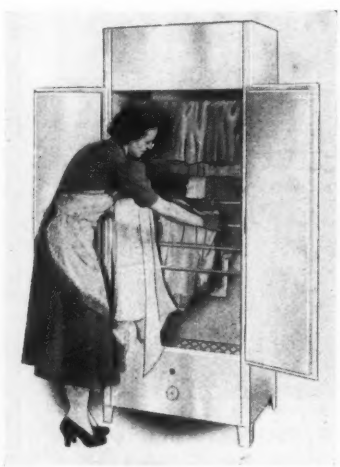

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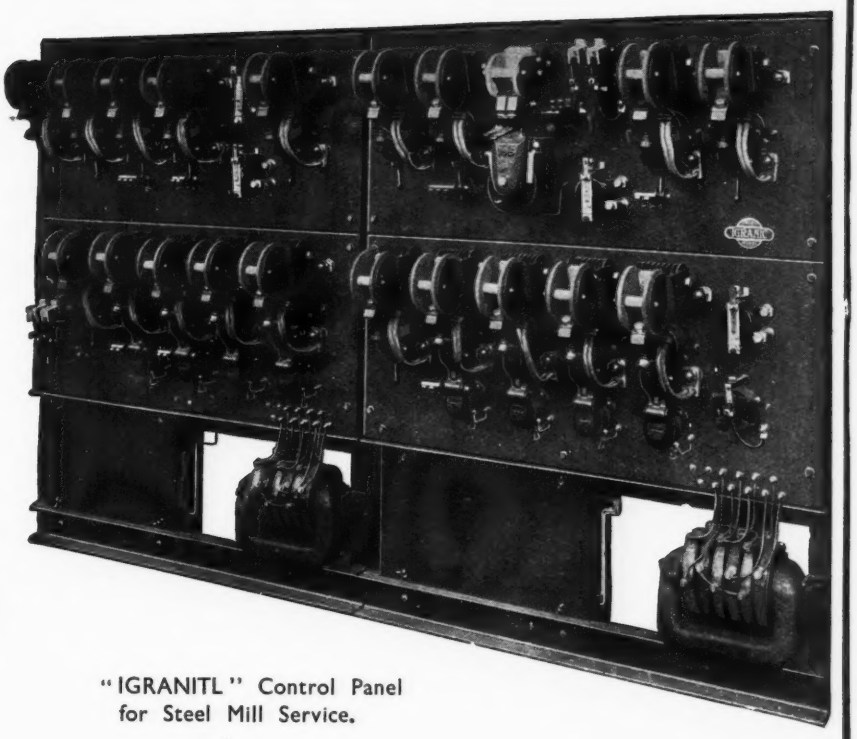

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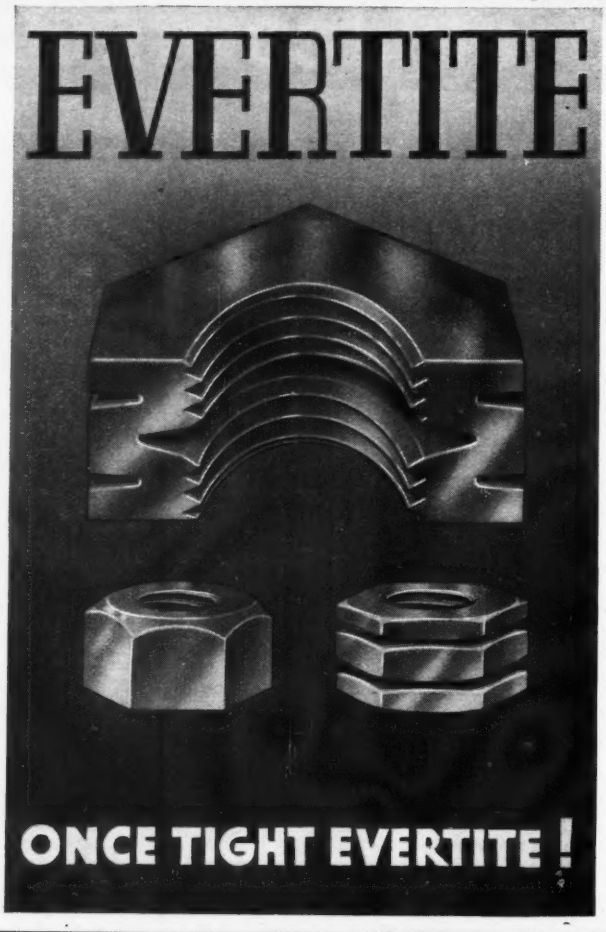

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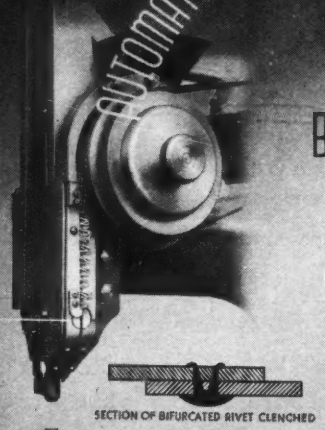

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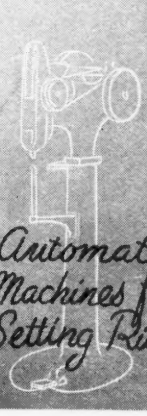

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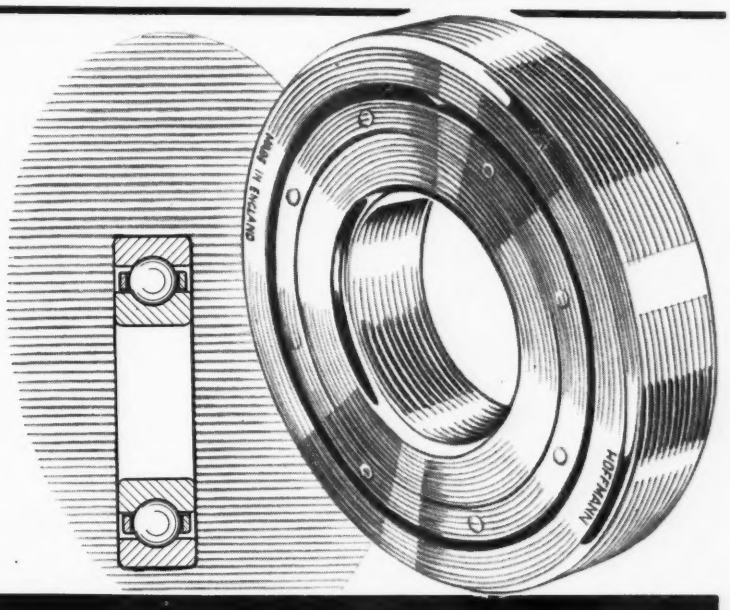

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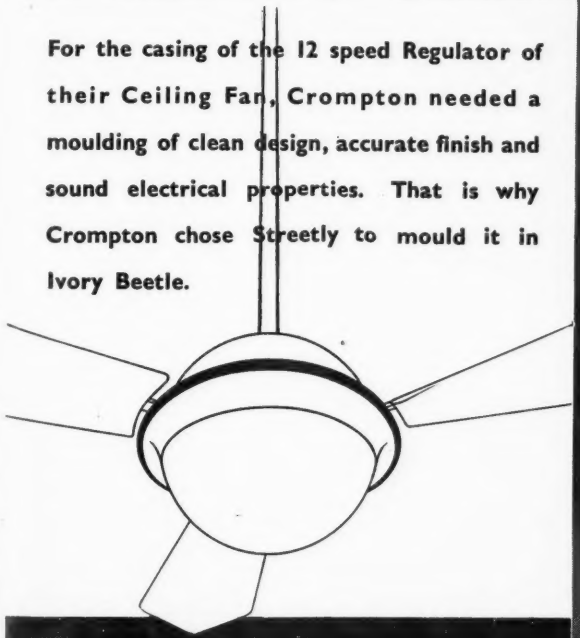

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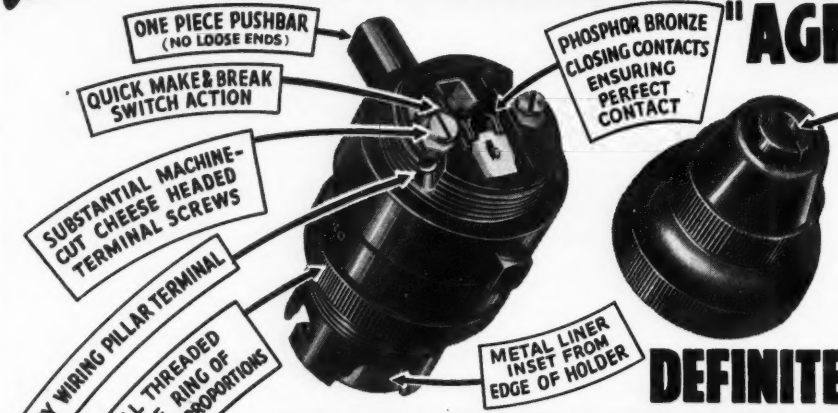
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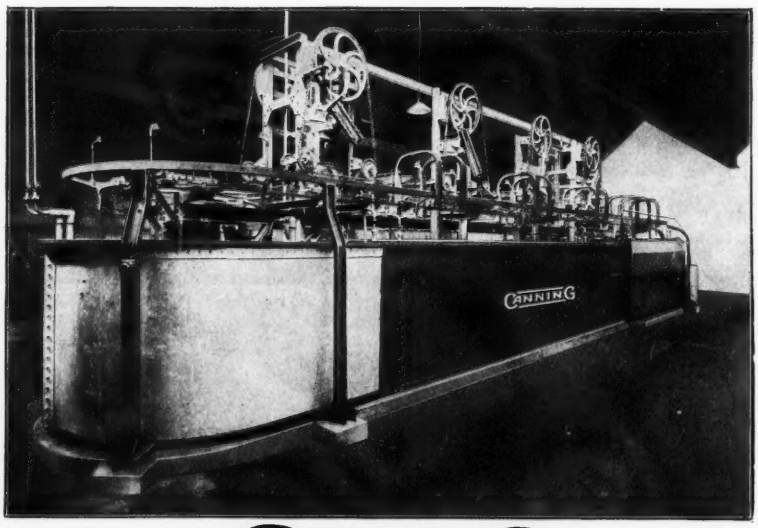

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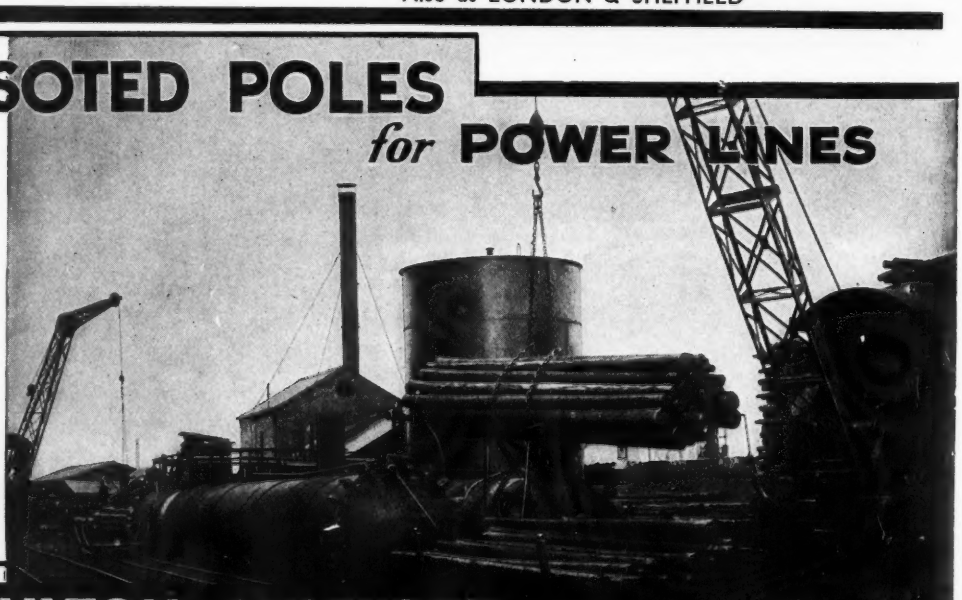

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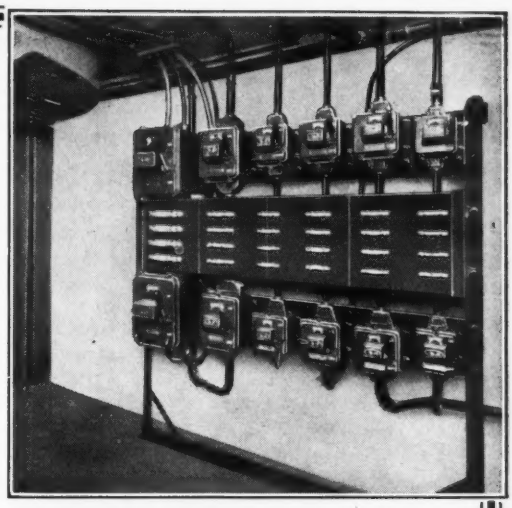

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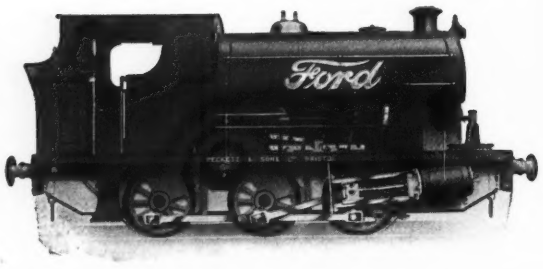

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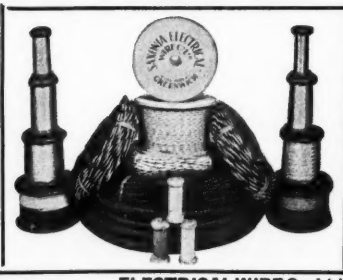

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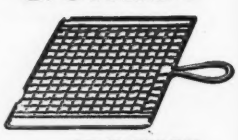

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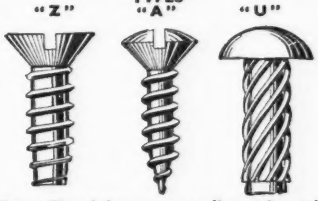

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PAGE

Aberdare Cables, Ltd. .....
A.C.E.C. (Ateliers de Constructions Electriques de Charleroi)
Aeraspray Mfg. Co., Ltd. .....
Agro Electrical Co., Ltd. xxviii
Aidas Electrical Co., Ltd. ... Sup. 4
Allnutt, Thos., & Co., Ltd. .....
Allom Bros., Ltd. ..... Sup. 20
Alton Battery Co., Ltd. .....
Appelbe, J. E., & Co. .....
"Architectural Review" .....
Armorduct Cable Co., Ltd. .....
Armstrong, Addison & Co., Ltd. .....
Aron Electricity Meter, Ltd. ...
Arrow Electric Switches, Ltd. ...
Artic Fuse & Electric Mfg. Co., Ltd. .....
Asea Electric, Ltd. .....
Assoc. of Steel Conduit Mfrs. Sup. 23
Atlas Lamp Works, Ltd. .....
Austin & Hayes .....
Automatic Coil Winder & Elecl. Equipment Co., Ltd. (The) .....

Babcock & Wilcox, Ltd. .....
Bakelite, Ltd. .....
Baldwins, Ltd. .....
Barber & Colman, Ltd. .....
Batteries, Ltd. .....
Beadle, T., & Co., Ltd. ... Sup. 22
Belgrave Works, Ltd. .....
Belling & Co., Ltd. .....
Belling & Lee, Ltd. .....
Benham & Sons, Ltd. .....
Benjamin Electric, Ltd. (The) xxxi
B.E.N. Patents, Ltd. xl
Berry's Electric, Ltd. xxii
Berry Wiggins & Co., Ltd. .....
Bertram Thomas iv
Bill Switchgear, Ltd. v
Birkby's, Ltd. .....
Birmingham Aluminium Casting (1903) Co., Ltd. .....
Birmingham Battery and Metal Co., Ltd. xxxiv
Birmingham Mica Co., Ltd. ... xxx
Blakeborough & Sons, Ltd., J.
Bolton, T., & Sons, Ltd. .....
Boving & Co., Ltd. .....
Bowker, S. O., Ltd. .....
Bratt, Colbran, Ltd. .....
Bridge Foundry Co., Ltd. .....
Brighton Lighting & Electrical Eng. Co., Ltd. xxxvii
Britannic Electric Cable and Construction Co., Ltd. .....
British Aluminium Co., Ltd. .....
British Electric Lamps, Ltd. xl
British Electric Resistance Co., Ltd. x
British Electric Transformer Co., Ltd. .....
British Insulated Cables, Ltd. Sup. 19
British Klockner Switchgear, Ltd.
British Mechanical Productions, Ltd. xxxvii
British Mica Co., Ltd. .....
British Monomark, Ltd. xxvi
British Oak Insurance Co., Ltd. Sup. 22
British Railways .....
British Thermostat Co., Ltd. .....
British Thomson-Houston Co., Ltd. (The) vii
British Timken, Ltd. .....
British Trane Co., Ltd. ..... Sup. 18
Briton Lamps, Ltd. .....
Brittain's Electric Motor Co. ...
Broadbent (Thomas) & Sons, Ltd. .....
Brook, J. A., Ltd. ..... Sup. 22
Brook Motors, Ltd. xix
Browett Lindley (1931), Ltd. .....
Brown Bros., Ltd. .....
Brownings Electric Co. xxxix
Bruce Peebles & Co., Ltd. iv
Brush Electrical Engineering Co., Ltd. .....
Buck & Hickman, Ltd. xxxi
"Builder (The)" .....
Bull Motors .....
Bullers, Ltd. .....
Bulpitt & Sons, Ltd. .....
Burco, Ltd. vi
Burgess Products Co., Ltd. .....
Burn, G., Ltd. xxiv
Burt, Boulton & Hayward, Ltd. xxviii

Cable Makers' Association .....
Callender's Cable & Construction Co., Ltd. .....
Cambridge Instrument Co., Ltd.
Canning, W., & Co., Ltd. ... xxviii
Carron Company xxvi
Carter & James, H. W., Ltd. xxx

PAGE

Castell, J. H. .....
Chamberlain & Hookham, Ltd. ...
Chloride Elecl. Storage Co., Ltd.
Christie's Wharf, Ltd. .....
City Electrical Co. .....
Clarke, H., & Co. (Manchester), Ltd. xliv
Clifford, Charles, & Sons, Ltd. ...
"Colliery Guardian (The)" .....
Collins Electrical, Ltd. .....
Commercial Structures, Ltd. .....
Commissioner for the Special Areas .....
Concordia Electric Wire Co., Ltd. (The) .....
Concrete Utilities, Ltd. ..... Sup. 2
Connollys (Blackley), Ltd. .....
Consolidated Pneumatic Tool Co., Ltd. (The) .....
Constructors, Ltd. .....
"Contract Journal (The)" .....
Copper Development Association
Cork Manufacturing Co., Ltd. (The) .....
Crabtree, J. A., & Co., Ltd. Sup. 9
Crane Foundry Co., Ltd. .....
Cressall Manufacturing Co., Ltd. Sup. 22
Crompton Parkinson, Ltd. .....
Croydon Engineering Co., Ltd. ...
Crypton Equipment, Ltd. .....
Cryselco, Ltd. ..... Sup. 4
Curtis Manufacturing Co., Ltd. xxx

Dacier, Ltd. .....
Dalyte Electrical Co. .....
Davey, W. C., & Co. .....
Davidson & Co., Ltd. ..... Sup. 5
Davis & Timmins, Ltd. xlii
Dawson, E., & Co. .....
De La Rue (Thomas) & Co., Ltd.
Delco-Remy & Hyatt, Ltd. .....
Dellread Gears (Holdings) Co., Ltd. .....
Desoutter Bros., Ltd. .....
Donovan Electrical Co., Ltd. Sup. 17
Dootson, J., & Co., Ltd. .....
Dorman & Smith, Ltd. .....
Dowsing Co. (Elec. Mfrs.), Ltd.
D.P. Battery Co., Ltd. .....
Drake & Gorham Wholesale, Ltd. xxiv
Dubilier Condenser Co. (1925), Ltd. .....

Earle, Bourne & Co., Ltd. xlii
Earthing Clip Co. .....
Ebonestos Industries, Ltd. .....
Edison Swan Cables, Ltd. .....
Edison Swan Electric Co., Ltd. ...
Electric Construction Co., Ltd. ...
Electric Depot, Ltd. ..... Sup. 22
Electric Elements Co. xxxix
Electrical Commodities, Ltd. .....
Electrical Contractors' Assoc. ...
Electro Dynamic Construction Co., Ltd. ..... Sup. 20
Elliott Bros. (London), Ltd. .....
Ellison (George), Ltd. .....
Ellison Insulations, Ltd. xxv
E.M.B. Co., Ltd. v
Enfield Cable Works, Ltd. .....
Engineering & Lighting Equipment, Ltd. .....
English Electric Co., Ltd. ... ix & xvii
Euston Manufacturing Co., Ltd. Sup. 22
Evans, Adlard & Co., Ltd. .....
Evans, Fredk. W., Ltd. ..... Sup. 22
Evans, Joseph, & Sons (Wolverhampton), Ltd. .....
Evenlite, Ltd. .....
Everett, Edgcumbe & Co., Ltd. ...
Evershed & Vignoles, Ltd. .....

Falk, Stadelmann & Co., Ltd. ...
Ferguson, Pailin, Ltd. .....
Ferranti, Ltd. ..... xiii & Sup. 6
Filhol, J. P. ..... Sup. 22
Fitter & Poulton, Ltd. ..... Sup. 22
Flather & Co., Ltd. .....
Fluxite, Ltd. xxxvii
Foster Engineering Co., Ltd. ...
Fowler, John, & Co. (Leeds), Ltd. xxxiii
Fry's Metal Foundries, Ltd. ... xxxiv
Fuller Accumulator Co. (1926), Ltd. .....
Fuller Elecl. & Mfg. Co., Ltd. ...

Geipel, William, Ltd. .....
Geisel, Ernst .....
General Electric Co., Ltd. xvi & Sup. 10
Genristo, Ltd. .....
Gent & Co., Ltd. .....
Gilbert, A. C., Co. (The) .....
Gilby-Brunton, Ltd. ..... Sup. 20
Gilkes, G., & Gordon, Ltd. .....
Gilson, D., & Co., Ltd. .....

PAGE

Gittings & Hills, Ltd. .....
Glass Fibres, Ltd. ..... Sup. 24
Gledhill-Brook Time Recorders, Ltd. ..... Sup. 22
Glenfield & Kennedy, Ltd. .....
Glover, W. T. & Co., Ltd. .....
Godwin, H. J., Ltd. ..... Sup. 18
Grafton Electric Co. .....
Graham, A., & Co., Ltd. .....
Green, Horace, & Co., Ltd. .....
Greenwood & Batley, Ltd. .....
Grey & Marten, Ltd. .....
Griffiths Bros. & Co., London, Ltd. xxxix
Grosvenor Utilities, Ltd. .....

Hague & McKenzie, Ltd. .....
Hampton Works (Stampings), Ltd. (The) .....
Harcourts, Ltd. .....
Harris, A. E., & Co. (Birmingham), Ltd. .....
Hart Accumulator Co., Ltd. ... xxiii
Heathman, J. H., Ltd. xxxiv
Heatrae, Ltd. iii
Heayberd, F. C., & Co. xxiii
Heenan & Froude, Ltd. .....
Helios Electric Lamp & Glass Works, Ltd. .....
Henley's, W. T., Telegraph Works Co., Ltd. ..... xiv & xv
Heyes & Co., Ltd. .....
Hick, Hargreaves & Co., Ltd. ...
Higgs Motors, Ltd. .....
Hoffmann Manufacturing Co., Ltd. xxvii
Holmes, J. H., & Co., Ltd. .....
Holophane, Ltd. .....
Horstman Gear Co., Ltd. (The)
Hotpoint Electric Appliance Co., Ltd. .....
Hughes, F. A., & Co., Ltd. .....

Iddon, Victor H., Ltd. .....
Ideal Boilers & Radiators, Ltd. xxxix
Igranic Electric Co., Ltd. xxv
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Kersons Manfg. Co., Ltd. (The)
Key Engineering Co., Ltd. xliii
Klaxon, Ltd. .....
Kniveton Cable Works, Ltd. .....

Lancashire Dynamo & Crypto, Ltd. .....
Landis & Gyr, Ltd. .....
Laurence Scott & Electromotors, Ltd. i
Lewis, H. K., & Co., Ltd. .....
Lightfoot Refrigeration Co., Ltd.
Lighting Trades, Ltd. .....
Linolite, Ltd. .....
Litholite Insulators and St. Albans Mouldings, Ltd. xxxi
Liverpool Elec. Cable Co.....
Londex, Ltd. .....
London Electric Firm xxx
London Electric Wire Co., Ltd....
Lorival Manufacturing Co. (1921), Ltd. .....
Low (Archibald) Electrics, Ltd.
Lundberg, A. P., & Sons, Ltd. ...
Lyons, Claude, Ltd. .....

Macintyre, J., & Co. xliii
Macpherson, Donald, & Co., Ltd.
Magna Wire & Cable Co., Ltd. ...
Manganese Bronze & Brass Co., Ltd. (The) .....
Mansell & Ogan, Ltd. .....
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McGeoch, Wm., & Co., Ltd. .....

PAGE

McGregor, R., & Co. .....
McKechnie Bros., Ltd. .....
McKinlay Electrical Manufacturing Co., Ltd. .....
M.C.L. & Repetition, Ltd. iii
Measurement, Ltd. xxi
Medway Corrugated Paper Co., Ltd. (The) .....
Mek-Elek Engineering, Ltd. Sup. 22
Mercury Switch Manufacturing Co., Ltd. .....
Metafiltration Co., Ltd. (The) ...
Metallic Seamless Tube Co., Ltd Sup. 18
Metropolitan Electric Supplies ...
Metropolitan-Vickers Electrical Co., Ltd. ..... Sup. 8 & 25
Midland Electric Manufacturing Co., Ltd. xli
"M.K." Electric, Ltd. .....
Moffats, Ltd. .....
Morse Chain Co., Ltd. (The) .....
Moulded Products, Ltd. .....

Nalder Bros. & Thompson, Ltd.
Nathan & Allen, Ltd. .....
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Normand Electrical Co., Ltd. .....
Northern Aluminium Co., Ltd. ... xi
Nuts and Bolts (Darlaston), Ltd. xxvi

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Ormond Engineering Co., Ltd. ...
Osler & Faraday, Ltd. .....
Outram, C. W., & Co., Ltd. .....
Ozonair, Ltd. .....

Painton & Co., Ltd. .....
Parmiter, Hope & Sugden, Ltd. xxxv
Parsons, C. A., & Co., Ltd. .....
Parsons, C. H., Ltd. .....
Partridge, Wilson & Co., Ltd. Sup. 22
Peckett & Sons, Ltd. xxx
Petters, Ltd. ..... Sup. 17
Philco Radio & Television Corporation of Great Britain, Ltd. .....
Philips Industrial .....
Philips Lamps, Ltd. xviii
Phosphor Bronze Co., Ltd. (The) .....
Pickerings .....
Pinchin, Johnson and Co., Ltd. ...
Pirelli-General Cable Works, Ltd. viii
Pitman, Sir Isaac, & Sons, Ltd.
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"Radio Times (The)" .....
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Revo Electric Co., Ltd. ..... Sup. 7
Revvo Castor Co., Ltd. .....
Reyrolle, A., & Co., Ltd. .....
Rich & Pattison (Birmingham), Ltd. .....
Richardsons, Westgarth-Brown Boveri, Ltd. .....
Rival Lamps, Ltd. .....
Robinson (Lionel) & Co., Ltd. ...
Ross Courtney & Co., Ltd. iii
Rotherham & Sons, Ltd. .....
Rotoplunge Pump Co., Ltd. .....
Rotunda, Ltd. .....
Rowlands Electrical Accessories, Ltd. .....
Rozalex, Ltd. .....
Ruberoid Co., Ltd. (The) .....
Runbaken Electrical Products Sup. 22

CONTINUED ON PAGE XXXIV

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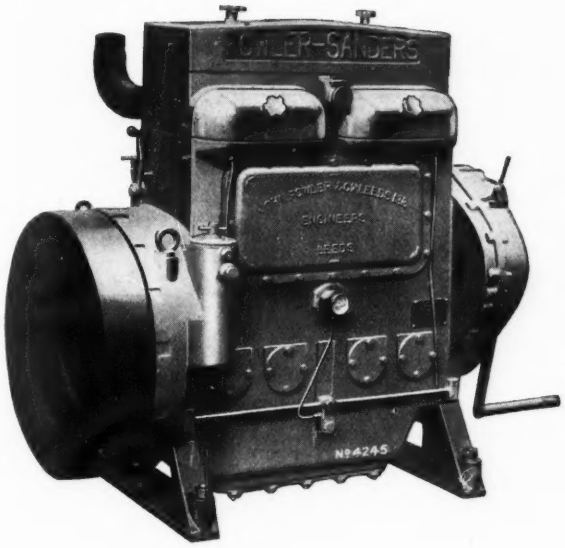

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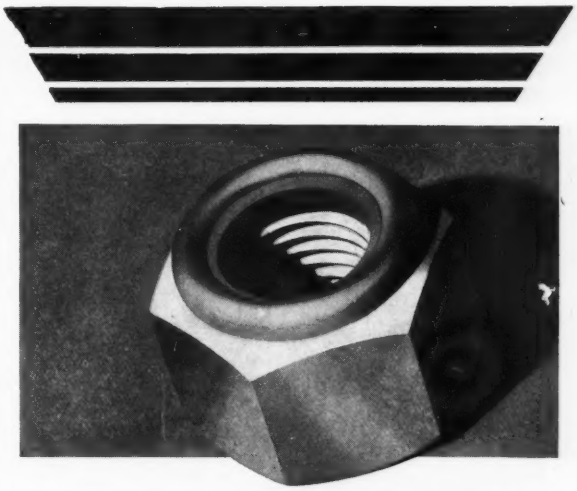

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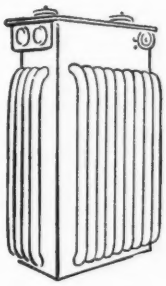

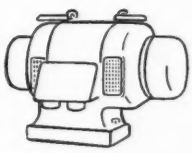

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INDEX TO ADVERTISERS—(*Continued from page xxxii*)

	PAGE
S. & D. Rivet Co.	xxvi
Sanders, W., & Co. (Wednesbury), Ltd.	
Sangamo-Weston, Ltd.	
Sankey (Joseph) & Sons, Ltd.	
Saxonia Elecl, Wire Co., Ltd.	xxx
Scott, Hugh J., & Co., (Belfast), Ltd.	
Scottish and Lanarkshire Industrial Estates	
Scottish Development Council	xliv
Screw Machine Products, Ltd.	
Service Electric Co., Ltd.	
Siemens Bros. & Co., Ltd.	
Siemens Electric Lamps & Supplies, Ltd.	Sup. 21
Siemens-Schuckert (Great Britain), Ltd.	
Sign Transformer Co., Ltd.	
Simmons Aerocessories, Ltd.	xxxiii
Simmonds & Stokes, Ltd.	xliii
Simon-Carves, Ltd.	
Simplex Electric, Ltd.	xii
Sims, F. D., Ltd.	
Smith (Frederick), & Co.	
Smith Meters, Ltd.	
Smith's Electric Clocks, Ltd.	
Sordoviso, Ltd.	
Sparklets, Ltd.	
Spencer Wire Co., Ltd. (The)	
Spicers, Ltd.	xliii
Stamford Electrical, Ltd.	
Standard Telephones & Cables, Ltd.	
Statter, J. G., & Co., Ltd.	
Steatite Insulations, Ltd.	
St. Helens Cable & Rubber Co., Ltd.	
Stirling Boiler Co., Ltd.	
Stream-Line Filters, Ltd.	
Streetly Manufacturing Co., Ltd.	xxvii
Sturdy Electric Co. (The)	
Sturtevant Engineering Co., Ltd.	
Sugg, William, & Co., Ltd.	
Summers, John, & Sons, Ltd.	
Switchgear & Cowans, Ltd.	
Symonds, R. H., Ltd.	
Tate, James, & Co.	
Taylor, Charles (Birmingham), Ltd.	
Taylor & Petters, Ltd.	xliii
Taylor, Tunnicliff & Co., Ltd.	
Telegraph Condenser Co., Ltd.	
Telegraph Construction and Maintenance Co., Ltd.	
Terry, Herbert, & Sons, Ltd.	
Thermal Syndicate, Ltd.	
Thermega, Ltd.	
Thermovent Heating	
Thomas & Son (Worcester), Ltd.	xxxi
Thorn Electrical Industries, Ltd.	
T.M.C.-Harwell (Sales), Ltd.	xxviii
Tok Switches, Ltd.	
Tormo, Ltd.	xl
Tourtel Manufacturing Co.	
Tucker, J. H., & Co., Ltd.	xx
Tudor Accumulator Co., Ltd.	
Tullis, Russell & Co., Ltd.	Sup. 24
Tungstalite, Ltd.	xxix
Typerlite Co. (The)	
Union Cable Co., Ltd.	
Union Lamp & Lighting Co., Ltd.	
Universal Winding Co.	
Vandervelde, L.	
Varley Magnet Co. (The)	
Veeder Root, Ltd.	
Venner Time Switches, Ltd.	ii
Vent-Axia, Ltd.	
Veritys, Ltd.	Sup. 1
V.G. Manufacturing Co., Ltd.	
Vincent Switchgear Mfg. Co., Ltd.	
Vulcanised Fibre, Ltd.	
Walsall Conduits, Ltd.	
Wandleside Cable Works, Ltd.	
Ward & Goldstone, Ltd.	Sup. 26
Ward, Thos. W., Ltd.	
Wardle Engineering Co., Ltd.	
"Water and Water Engineering"	
Weekes, L. (Luton), Ltd.	xxix
Weigand, Hans	
Weir, G. & J., Ltd.	
Wells, A. C., & Co., Ltd.	
Westinghouse Brake & Signal Co., Ltd.	Sup. 6
West Insulating Co., Ltd.	
Westminster Eng. Co., Ltd.	iii
Weston Elecl. Instrument Co., Ltd.	xxii
Westool, Ltd.	xxxiv
Whiteway Lighting, Ltd.	Sup. 17
Wiggin, Henry, & Co., Ltd.	
Wiggins, F., & Sons, Ltd.	
Woodfyt Sales, Ltd.	
Wootton & Co., Ltd.	
Worthington Simpson, Ltd.	
Wright, Alex., & Co., Ltd.	
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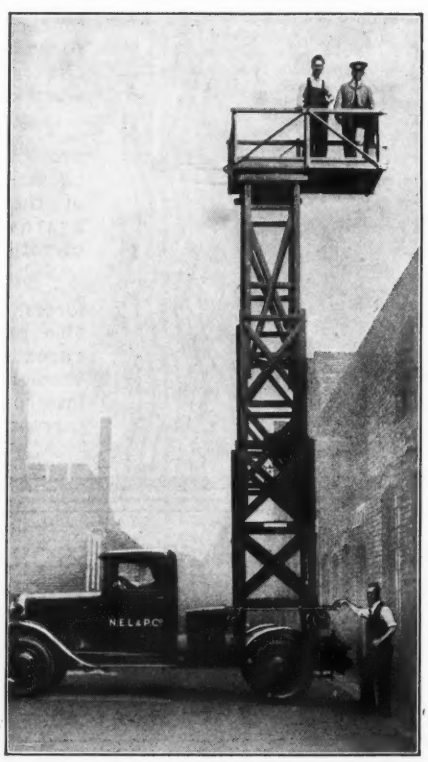

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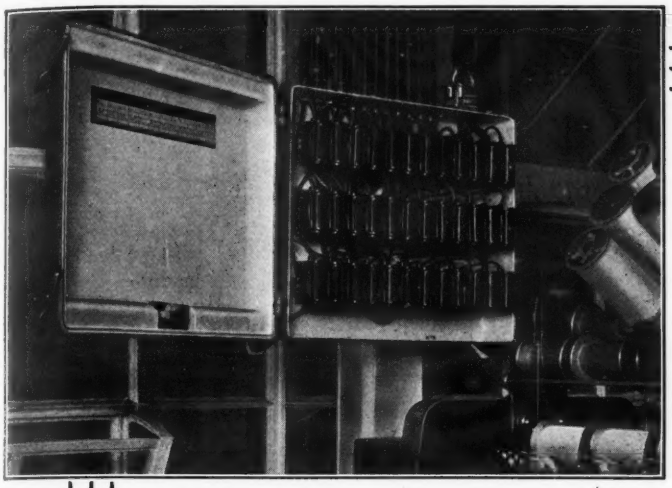

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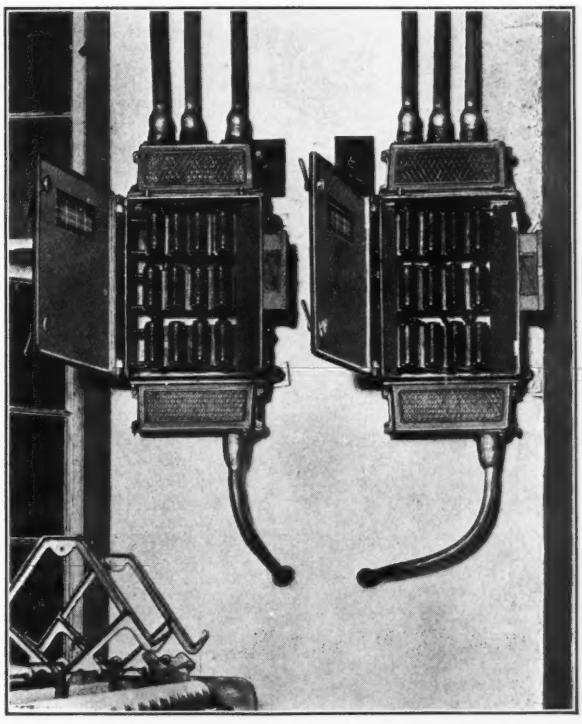

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CONTINUED ON PAGE XXXVIII

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COMPLETE UNIT FOR 80 OR 125 WATT MERCURY DISCHARGE LAMP

This bracket, which is 6′ high from the base of the bonnet to the base of the refractor, is suitable for mounting on existing lamp columns, which are usually 9′ 6″ high, to give a height to the light source of 15′ 6″.

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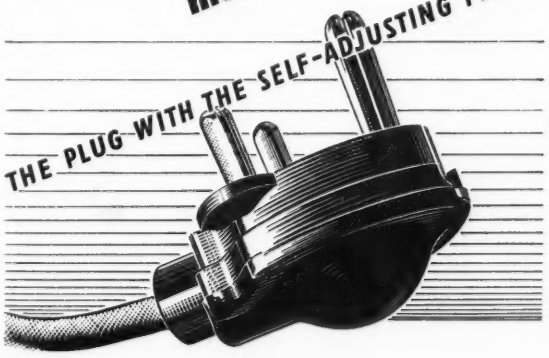

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CLASSIFIED INDEX OF ADVERTISEMENTS—(*Continued from page xxxvi*)

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Crabtree, J. A., & Co., Ltd.

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British Electric Lamps, Ltd.

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Tourtel Mnfg. Co.

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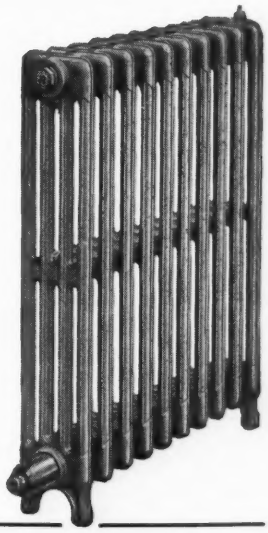

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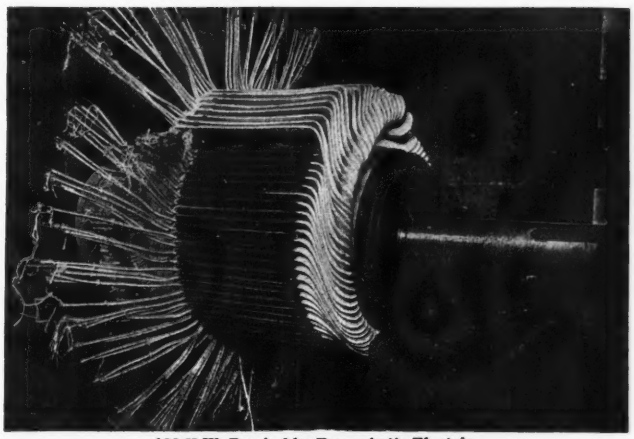

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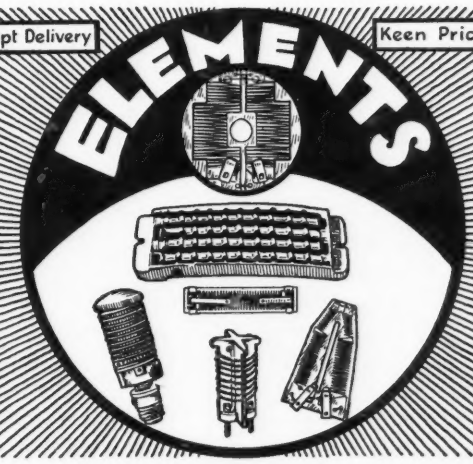

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CLASSIFIED INDEX OF ADVERTISEMENTS—(*Continued from page xxxviii*)

Switchgear (Ironclad)—Contd.
Siemens-Schuckert (G.B.), Ltd.
Simplex Electric Co., Ltd.
Statter, J. G., & Co., Ltd.
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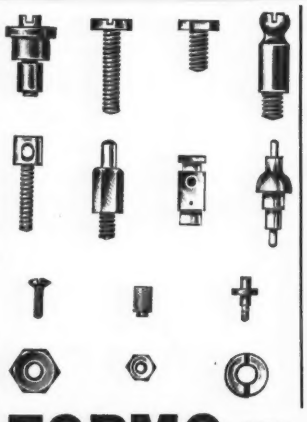

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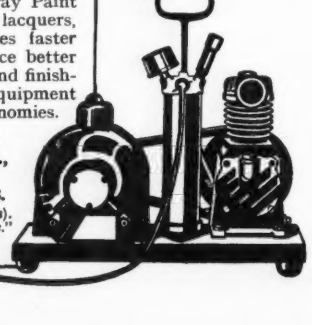

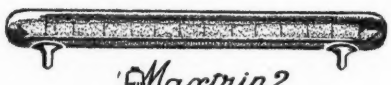

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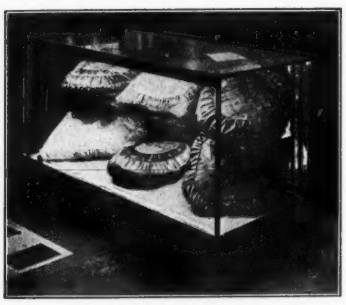

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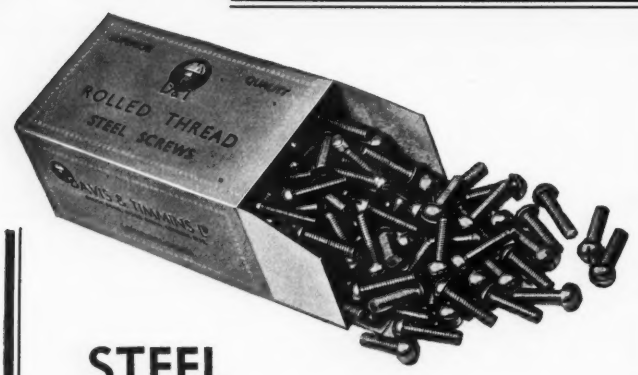

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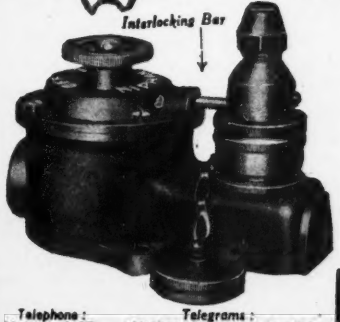

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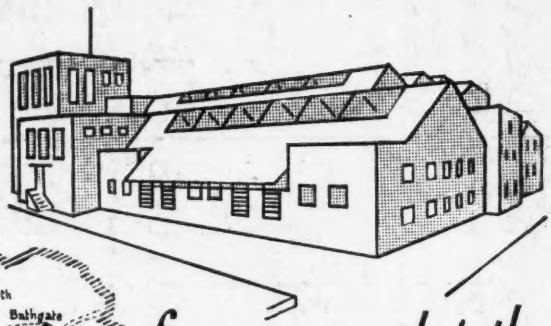

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